Chapter 4
ENVIRONMENTAL CONSEQUENCES

This chapter provides an analysis of the potential environmental effects of implementing each of the three alternative fire management plans described in Chapter Two. Each of the resource areas whose affected environment was described in Chapter Three is addressed here.

The study team conducted the investigation and analyses by gathering the data they concluded were relevant for each resource area. Using these data, the team determined which impacts would occur and assessed them according to their duration, extent, intensity, and whether or not the impact would cause an impairment of Sleeping Bear Dunes National Lakeshore's resources. These parameters are defined below. Potential mitigation measures were also identified and analyzed to reduce or avoid potential adverse impacts resulting from the Proposed Action (see Section 2.7 of this EA).

In each resource area, the impacts of the No Action alternative (Alternative 1, implementation of the existing FMP) are first discussed. Each of the two other alternatives, including the Preferred Alternative, is then compared to the No Action alternative in turn.

4.1 DEFINITIONS

4.1.1 Intensity, Duration and Type of Impact

The evaluation of alternatives takes into account the intensity, duration, extent, and type of impacts. The intensity of impacts may be negligible, minor, moderate, or major; with negligible being undetectable, minor being barely detectable, moderate being clearly detectable, and major being a substantial alternation of current conditions. Duration of impacts is evaluated based on the short-term or long-term nature of the effects of the alternative and associated changes on existing conditions. Extent of impact is evaluated based on whether the impacts are localized or regional. Type of impact refers to the beneficial or adverse consequences of implementing a given alternative. More exact interpretations of intensity, duration, and type of impact are given for each resource area examined. Professional judgment is used to reach reasonable conclusions as to the intensity and duration of potential impacts.

Geology and Soils

The impact thresholds used for describing the effects on geology and soils of implementing the proposed FMP are as follows:

Negligible — Soils would not be affected or the effects to soils would be below or at the lower levels of detection. Any effects to soil productivity or fertility would be slight And no long-term effects to soils would occur.

Minor — The effects to soils would be detectable. Effects to soil productivity or fertility would be small, as would the area affected. If mitigation were needed to offset adverse effects, it would be relatively simple to implement and would likely be successful.

Moderate — The effect on soil productivity or fertility would be readily apparent, likely long-term, and result in a change to the soil character over a relatively wide area. Mitigation measures would probably be necessary to offset adverse effects and would likely be successful.

Major — The effect on soil productivity or fertility would be readily apparent, long-term, and substantially change the character of the soils over a large area in and out of the Lakeshore. Mitigation measures to offset adverse effects would be needed, extensive, and their success could not be guaranteed.

Impairment — A major, adverse impact to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of Sleeping Bear Dunes National Lakeshore; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's general management plan or other relevant National Park Service planning documents.

Duration — Short-term - Recovers in less than three years.
Long-term - Takes more than three years to recover.

Water Resources

The impact thresholds used for describing the effects on water resources of implementing the proposed FMP are as follows:

Negligible — Water quality would not be affected, or changes would be either non-detectable or if detected, would have effects that would be considered slight, local, and short-term.

Minor — Changes in water quality or hydrology would be measurable, although the changes would be small, likely short-term, and the effects would be localized. No mitigation measure associated with water quality or hydrology would be necessary.

Moderate — Changes in water quality or hydrology would be measurable and long-term but would be relatively local. Mitigation measures associated with water quality or hydrology would be necessary and the measures would likely succeed.

Major — Changes in water quality or hydrology would be readily measurable, would have substantial consequences, and would be noticed on a regional scale. Mitigation measures would be necessary and their success would not be guaranteed.

Impairment — A major, adverse impact to the water quality that would directly affect a resource

whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of Sleeping Bear Dunes National Lakeshore (2) key to the natural or cultural integrity of the Lakeshore; or (3) identified as a goal in the Lakeshore's general management plan or other relevant National Park Service planning documents.

Duration — Short-term - Following treatment recovery will take less than one year. Long-term - Following treatment recovery will take longer than one year.

Floodplains and Wetlands

The impact thresholds used for describing the effects on floodplains and wetlands of implementing the proposed FMP are as follows:

Negligible — Floodplains would not be affected, or changes would be either non-detectable or if detected, would have effects that would be considered slight, local, and would likely be short-term. In addition, there would be no change to existing wetland area or function, the ability of a floodplain to convey floodwaters, or to riparian vegetation and wildlife communities.

Minor — Changes in floodplains would be measurable, although the changes would be small, would likely be short-term, and the effects would be localized. No mitigation measure associated with water quality or hydrology would be necessary. In addition, there would be no change in wetland or floodplain area and function. The action would affect a few individuals of plant or wildlife species within an existing wetland or riparian area within the Lakeshore. The change would require considerable scientific effort to measure and have barely perceptible consequences to wetland or riparian habitat function.

Moderate — Changes in floodplains would be measurable and long-term but would be relatively local. Mitigation measures associated with water quality or hydrology would be necessary and the measures would likely succeed. A moderate impact is an action that would change an existing wetland area or floodplain function, but the impact could be mitigated by the creation of artificial wetlands or modification of proposed facilities in floodplains. The action would have a measurable effect on plant or wildlife species within an existing wetland or riparian area, but all species would remain indefinitely viable within the Lakeshore.

Major — Changes in floodplains would be readily measurable, would have substantial consequences, and would be noticed on a regional scale. Mitigation measures would be necessary and their success would not be guaranteed. In addition, there would be drastic and permanent consequences for an existing wetland area or floodplain function which could not be mitigated. Wetland and riparian species dynamics would be upset, and species would be at risk of extirpation from the Lakeshore.

Impairment — A major, adverse impact to floodplains and/or wetlands that would directly affect a resource whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of Sleeping Bear Dunes National Lakeshore (2) key to the natural or cultural integrity of the Lakeshore; or (3) identified as a goal in the Lakeshore's general management plan or other relevant National Park Service planning documents.

Duration — Short-term - Following treatment, recovery will take less than one year.
Long-term - Following treatment, recovery will take longer than one year.

Air Quality

Negligible — No changes would occur or changes in air quality would be below or at the level of detection, and if detected, would have effects that would be considered slight and short-term.

Minor — Changes in air quality would be measurable, although the changes would be small, short-term, and the effects would be localized. No air quality mitigation measures would be necessary.

Moderate — Changes in air quality would be measurable, would have consequences, although the effect would be relatively local. Air quality mitigation measures would be necessary and the measures would likely be successful.

Major — Changes in air quality would be measurable, would have substantial consequences, and be noticed regionally. Air quality mitigation measures would be necessary and the success of the measures could not be guaranteed.

Impairment — A major, adverse impact to air quality that would directly affect a resource whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of Sleeping Bear Dunes National Lakeshore (2) key to the natural or cultural integrity of the Lakeshore; or (3) identified as a goal in the Lakeshore's general management plan or other relevant National Park Service planning documents.

Duration — Short-term - Recovers in seven days or less.
Long-term – Takes more than seven days to recover.

Vegetation

The impact thresholds used for describing the effects on vegetation of implementing the proposed FMP are as follows:

Negligible — No native vegetation would be affected or some individual native plants could be affected as a result of the alternative, but there would be no effect on native species populations. The effects would be short-term, on a small scale, and no species of special concern would be affected.

Minor — The alternative would affect some individual native plants and would affect a relatively minor portion of that species' population. Mitigation to offset adverse effects, including special measures to avoid affecting species of special concern, could be required and would be effective.

Moderate — The alternative would affect some individual native plants and would also affect a sizeable segment of the species' population in the long-term and over a relatively large area. Mitigation to offset adverse effects could be extensive, it would likely be successful. Some species of special concern could also be affected.

Major — The alternative would have a considerable long-term effect on native plant populations, including species of special concern, and affect a relatively large area in and out of the Lakeshore. Mitigation measures to offset the adverse effects would be required, extensive, and success of the mitigation measures would not be guaranteed.

Impairment — A major, adverse impact to vegetation whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of Sleeping Bear Dunes National Lakeshore (2) key to the natural or cultural integrity of the Lakeshore; or (3) identified as a goal in the Lakeshore's general management plan or other relevant National Park Service planning documents.

Duration — Short-term: Recovery or condition improvement in less than five years. Long-term: Takes more than five years to recover or improve.

Wildlife and Fisheries

The impact thresholds used for describing the effects on wildlife of implementing the proposed FMP are as follows:

Negligible — Wildlife would not be affected or the effects would be at or below the level of detection, would be short-term, and the changes would be so slight that they would not be of any measurable or perceptible consequence to the wildlife species' population.

Minor — Effects to wildlife would be detectable, although the effects would be localized, and would be small and of little consequence to the species' population. Mitigation measures, if needed to offset adverse effects, would be simple and successful.

Moderate — Effects to wildlife would be readily detectable, long-term and localized, with consequences at the population level. Mitigation measures, if needed to offset adverse effects, would be extensive and likely successful.

Major — Effects to wildlife would be obvious, long-term, and would have substantial consequences to wildlife populations in the region. Extensive mitigation measures

would be needed to offset any adverse effects and their success would not be guaranteed.

Impairment — A major, adverse impact to wildlife values or habitat whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of Sleeping Bear Dunes National Lakeshore (2) key to the natural or cultural integrity of the Lakeshore; or (3) identified as a goal in the Lakeshore's general management plan or other relevant National Park Service planning documents.

Duration — Short-term - Recovers in less than three years.
Long-term - Takes more than three years to recover.

Threatened and Endangered Species

The impact thresholds used for describing the effects on special status species of implementing the proposed FMP are as follows:

Negligible — An action that would not affect any individuals of a sensitive species or their habitat within Sleeping Bear Dunes National Lakeshore

Minor — An action that would affect a few individuals of sensitive species or have very localized impacts upon their habitat within Sleeping Bear Dunes National Lakeshore. The change would require considerable scientific effort to measure and have barely perceptible consequences to the species or habitat function.

Moderate — An action that would cause measurable effects on: (1) a relatively moderate number of individuals within a sensitive species population, (2) the existing dynamics between multiple species (e.g., predator-prey, herbivore-forage, vegetation structure-wildlife breeding habitat), or (3) a relatively large habitat area or important habitat attributes within Sleeping Bear Dunes National Lakeshore. A sensitive species population or habitat might deviate from normal levels under existing conditions, but would remain indefinitely viable within the Lakeshore.

Major — An action that would have drastic and permanent consequences for a sensitive species population, dynamics between multiple species, or almost all available critical or unique habitat area within Sleeping Bear Dunes National Lakeshore. A sensitive species population or its habitat would be permanently altered from normal levels under existing conditions, and the species would be at risk of extirpation from the Lakeshore.

Impairment — A major, adverse impact to protected wildlife values or habitat whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of Sleeping Bear Dunes National Lakeshore (2) key to the natural or cultural integrity of the Lakeshore; or (3) identified as a goal in the Lakeshore's general management plan or other relevant National Park Service planning documents.

Duration Short-term - Recovers in less than two years.
Long-term - Takes more than two years to recover.

Wilderness

The impact thresholds used for describing the effects on wilderness of implementing the proposed FMP are as follows:

Negligible A change in the wilderness character would not occur, or if it occurred, would be so small that it would not be of any measurable or perceptible consequence.

Minor A change in the wilderness character and associated values would occur, but it would be small and, if measurable, would be temporary and highly localized.

Moderate A change in the wilderness character and associated values would occur. It would be measurable, but localized.

Major A noticeable change in the wilderness character and associated values would occur. It would be measurable, and would have a substantial or possibly permanent consequence.

Impairment A major, adverse impact that directly impairs the wilderness affecting any of the resources whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of Sleeping Bear Dunes National Lakeshore (2) key to the natural or cultural integrity of the Lakeshore; or (3) identified as a goal in the Lakeshore's general management plan or other relevant National Park Service planning documents.

Duration Short-term - Recovers in less than one year.
Long-term - Takes more than one year to recover.

Noise (Soundscapes)

The impact thresholds used for describing the effects on noise of implementing the proposed FMP are as follows:

Negligible In more developed areas of the park, human-caused noise may be present much of the time during daylight hours, but it is rarely audible between sunset and sunrise at distances more than 500 feet from the noise source. When noise is present, it is mostly at low levels. Visitors have opportunities to experience the natural soundscape free from human-caused noise frequently during the day, and almost always between sunset and sunrise. In the backcountry and wilderness areas, natural sounds predominate. Human-caused noise is rarely audible at 100 feet or more from the noise source. When noise is present, it is at very low levels and occurs only for short durations in most of the area. Visitors almost always have the opportunity to experience the natural soundscape free from human-caused noise.

Minor — In more developed areas of the park, human-caused noise may predominate during daylight hours, but for the majority of the time the noise is at low levels, and is only rarely at greater than medium levels. Human-caused noise is rarely audible between sunset and sunrise at 500 feet or more from the noise source. In the backcountry and wilderness areas, natural sounds usually predominate. Human-caused noise is present only infrequently, and occurs only at low levels and for short durations in most of the area. Visitors have the opportunity to experience the natural soundscape free from human-caused noise most of the time in most of the area. Human-caused noise is rarely audible between sunset and sunrise at 100 feet or more from the noise source.

Moderate — In more developed areas of the park, human-caused noise predominates during daylight hours, but it is at medium or lower levels a majority of the time. Localized areas may experience human-caused noise at medium to high levels during half of the daylight hours. Human-caused noise is occasionally audible between sunset and sunrise at 500 feet or more from the noise source. In the backcountry and wilderness areas, human-caused noise is present infrequently to occasionally, at low to medium levels and durations. Human-caused noise is occasionally audible between sunset and sunrise at 100 feet or more from the noise source.

Major — In more developed areas of the park, human-caused noise predominates during daylight hours, and is at greater than medium levels a majority of the time that noise is present. Large areas may experience human-caused noise at medium to high levels during a majority of the daylight hours. Human-caused noise is often audible between sunset and sunrise at 500 feet from the noise source. In the backcountry and wilderness areas, natural sounds commonly are masked by human-caused noise at low or greater levels for extended periods of time. Human-caused noise is frequently audible between sunset and sunrise at 100 feet from the noise source.

Impairment — In more developed areas of the park, the natural soundscape would be impacted at major levels frequently or for extended periods of time in the majority of the area. Human-caused noise is frequently audible between sunset and sunrise at 500 feet from the noise source. The purpose and mission of the area in the park can not be fulfilled.

Duration — Short-term - Noise lasts less than one year.
Long-term - Noise more than one year to recover.

Cultural Resources

The impact thresholds used for describing the effects on cultural resources of implementing the proposed FMP are as follows:

Negligible — Impact on historic structures and archeological resources is at the lowest levels of detection with neither adverse nor beneficial consequences. The determination of

effect for §106 would be *no adverse effect*. Impacts on ethnographic resources would be barely perceptible and would neither alter resource conditions, such as traditional access or site preservation, nor the relationship between the resource and the affiliated group's body of practices and beliefs. The determination of effect on Traditional Cultural Properties (ethnographic resources eligible to be listed in the National Register) for §106 would be *no adverse effect.*

Minor

Adverse: disturbance of historic structures archeological site(s) results in little, if any, loss of integrity. The determination of effect for §106 would be *no adverse effect*. Ethnographic impact(s) would be slight but noticeable but would neither appreciably alter resource conditions, such as traditional access or site preservation, nor the relationship between the resource and the affiliated group's body of practices and beliefs. The determination of effect on Traditional Cultural Properties (ethnographic resources eligible to be listed in the National Register) for §106 would be *no adverse effect*.

Beneficial: maintenance and preservation of historic structure(s) and archeological site(s). The determination of effect for §106 would be *no adverse effect*. With regard to ethnographic resources, would allow access to and/or accommodate a group's traditional practices or beliefs. The determination of effect on Traditional Cultural Properties for §106 would be *no adverse effect.*

Moderate

Adverse: disturbance of historic structure(s) and archeological site(s) results in loss of integrity. The determination of effect for §106 would be *adverse effect*. A MOA is executed among the NPS and State Historic Preservation Officer/Tribal Historic Preservation Officer (SHPO/THPO) and, if necessary, Advisory Council on Historic Preservation (ACHP) per 36 CFR 800.6(b). Mitigation Measures in Memorandum of Agreement (MOA) minimize or mitigate adverse impacts and reduce the intensity of impact from major to moderate. Ethnographic impact(s) would be apparent and would alter resource conditions. Something would interfere with traditional access, site preservation, or the relationship between the resource and the affiliated group's practices and beliefs, even though the group's practices and beliefs would survive. The determination of effect on Traditional Cultural Properties (ethnographic resources eligible to be listed in the National Register) for §106 would be *adverse effect*.

Beneficial: stabilization of historic structure(s) and archeological site(s). The determination of effect for §106 would be *no adverse effect*. Would facilitate traditional access and/or accommodate a group's practices or beliefs. The determination of effect on Traditional Cultural Properties for §106 would be *no adverse effect.*

Major

Adverse: disturbance of historic structure(s) and archeological site(s) results in loss of integrity. The determination of effect for §106 would be *adverse effect*. Measures to minimize or mitigate adverse impacts cannot be agreed upon and the NPS and applicable SHPO/THPO/ACHP are unable to negotiate and execute a MOA in accordance with 36 CFR 800.6(b). Ethnographic impact(s) would alter

resource conditions. Something would block or greatly affect traditional access, site preservation, or the relationship between the resource and the affiliated group's body of practices and beliefs, to the extent that the survival of a group's practices and/or beliefs would be jeopardized. The determination of effect on Traditional Cultural Properties (ethnographic resources eligible to be listed in the National Register) for §106 would be *adverse effect*.

Beneficial: active intervention to preserve historic structure(s) and archeological site(s). The determination of effect for §106 would be *no adverse effect*. Would encourage traditional access and/or accommodate a group's practices or beliefs. The determination of effect on Traditional Cultural Properties for §106 would be *no adverse effect*.

Impairment — A major, adverse impact to a cultural resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of Sleeping Bear Dunes National Lakeshore; (2) key to the natural or cultural integrity of the Lakeshores; or (3) identified as a goal in the Lakeshores general management plan or other relevant National Park Service planning documents.

Duration — Short-term: Return to desired condition, or improvement to desired condition of structure(s) and sites(s) takes place in one year or less; ethnographic resources recover in less than three years.
Long-term: Return to desired condition, or improvement to desired condition of structure(s) and site(s) takes place in over one year but less than 10 years. Ethnographic resources take more than three years to recover.
Permanent: The effects of the action last longer than 10 years, or are permanent, or nearly permanent.

Land Use

The impact thresholds used for describing the effects on land use of implementing the proposed FMP are as follows:

Negligible — The impact is barely detectable and/or will affect few neighbors.

Minor — The impact is slight, but detectable, and/or will affect a minority of neighbors.

Moderate — The impact is readily apparent and/or will affect many neighbors.

Major — The impact is severely adverse or exceptionally beneficial and/or will affect the majority of neighbors.

Duration — Short-term – Effects last one year or less.
Long-term – Effects last longer than one year.

Healthy and Safety

The impact thresholds used for describing the effects on health and safety of implementing the proposed FMP are as follows:

Negligible — Public health and safety would not be affected, or the effects would be at low levels of detection and would not have an appreciable effect on the public health or safety.

Minor — The effect would be detectable and would likely be short-term, but would not have an appreciable effect on public health and safety. If mitigation were needed, it would be relatively simple and would likely be successful.

Moderate — The effects would be readily apparent and long-term, and would result in substantial, noticeable effects to public health and safety on a local scale. Mitigation measures would probably be necessary and would likely be successful.

Major — The effects would be readily apparent and long-term, and would result in substantial, noticeable effects to public health and safety on a regional scale. Extensive mitigation measures would be needed, and their success would not be guaranteed.

Duration — Short-term – Effects last one year or less.
Long-term – Effects last longer than one year.

Public Services

The impact thresholds used for describing the effects on public services of implementing the proposed FMP are as follows:

Negligible — Public services would not be affected, or the effects would be at low levels of detection and would not have an appreciable effect on public services.

Minor — The effect would be detectable and would likely be short-term, but would not have an appreciable effect on public services. If mitigation were needed, it would be relatively simple and would likely be successful.

Moderate — The effects would be readily apparent and long-term, and would result in substantial, noticeable effects to public services on a local scale. Mitigation measures would probably be necessary and would likely be successful.

Major — The effects would be readily apparent and long-term, and would result in substantial, noticeable effects to public services on a regional scale. Extensive mitigation measures would be needed, and their success would not be guaranteed.

Duration — Short-term – Effects last one year or less.
Long-term – Effects last longer than one year.

Park Facilities and Operations, Visitor Use and Experience

The impact thresholds used for describing the effects on park facilities, visitor use and experiences of implementing the proposed FMP are as follows

Negligible — Park operations would not be affected, or the effects would be at low levels of detection and would not have an appreciable effect on park operations. Visitors would not be affected or changes in visitor use and/or experience would be below or at the level of detection. Any effects would be short-term. The visitor would not likely be aware of the effects associated with the alternative.

Minor — The effect would be detectable and likely short-term, but would be of a magnitude that would not have an appreciable effect on Lakeshore operations. If mitigation was needed to offset adverse effects, it would be simple and likely successful. Changes in visitor use and/or experience would be detectable, although the changes would be slight and likely short-term. The visitor would be aware of the effects associated with the alternative, but the effects would be slight.

Moderate — The effects would be readily apparent, likely long-term, and would result in a substantial change in park operations in a manner noticeable to staff and the public. Mitigation measure would be necessary to offset adverse effects and would likely be successful. Changes in visitor use and/or experience would be readily apparent and likely long-term. The visitor would be aware of the effects associated with the alternative and would likely be able to express an opinion about the changes.

Major — The effects would be readily apparent, long-term, would result in a substantial change in park operation in a manner noticeable to staff and the pubic and be markedly different from existing operations. Mitigation measure to offset adverse effects would be needed, would be extensive and their success could not be guaranteed. Changes in visitor use and/or experience would be readily apparent and have important long-term consequences. The visitor would be aware of the effects associated with the alternative and would likely express a strong opinion about the changes.

Impairment — A major, adverse impact that affects park operations to the extent that would limit or halt the protection of any of the resources whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of Sleeping Bear Dunes National Lakeshore (2) key to the natural or cultural integrity of the Lakeshore; or (3) identified as a goal in the Lakeshore's general management plan or other relevant National Park Service planning documents.

Duration — Short-term – Effects lasting for less than one year.
Long-term – Effects lasting for more than one year.

4.1.2 Impairment of Park Resources

The study team analyzed whether impacts would result in an impairment of park resources based on guidelines set forth in NPS Management Policies (NPS, 2001; Sections 1.42, 1.4.4, 1.4.5). Impairment occurs when an impact degrades or harms the integrity of park resources or values, including opportunities that would otherwise normally be available for the enjoyment of those resources or values had the impact not occurred. Under the NPS Organic Act and the General Authorities Act, impairment of park resources is prohibited.

NPS Management Policies outline the conditions under which an impact would be likely to result in an impairment of park resources. According to the Policies, an impact would likely create an impairment to the extent that the conservation of the affected resource or value is: 1) essential to fulfill a purpose established in the enabling legislation or proclamation of the park; 2) key to the integrity (natural or cultural) of the park or its opportunities, or 3) identified as a goal in the General Management Plan for the park. If an impact is an unavoidable result of an action required to maintain or restore the integrity of park resources or values, and cannot be reasonably mitigated, the impact would be less likely to constitute an impairment of park resources.

4.1.3 Cumulative Impacts

A cumulative impact is an impact on the natural or human environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of which agency, organization, or person undertakes such other actions (40 CFR 1508.7). Cumulative impacts can result from individually minor and insignificant, but collectively significant actions, taking place over a period of time.

Cumulative impacts were assessed by combining the potential environmental impacts of the alternatives with the potential impacts of known projects or activities occurring or projected to occur within the region of the Proposed Action. The most important relevant activity that will be taking place in the foreseeable future across the region is an increase in the rate of prescribed fires on State, Federal, and Tribal lands as a method of habitat management and reducing the hazardous buildup of fuels.

4.2 NATURAL RESOURCES

4.2.1 Geology and Soils

Methodology for Assessing Impacts

Soil impacts were qualitatively assessed using literature review, professional judgment, and experience with comparable actions. There would be no impairment of geologic or soil resources or related values, especially the dunes themselves, at Sleeping Bear Dunes National Lakeshore as a result of the implementation of any of the alternatives.

Alternative 1 – No Action (Suppress All Wildland Fires and Exclude Prescribed Fire)

In the recent past wildland fires have affected a relatively small area of the park. Thus, the expected extent of impacts from the No Action Alternative would be relatively small, but extreme droughts could increase the affected area.

Alternative 1 would have a negligible impact on the park's geologic features and values, in particular the dunes themselves that are the park's namesake, and the Lakeshore's beaches and shoreline. It would likely, however, have long-term, localized to regional, negligible to moderate impacts on soils in the park at sites that are vegetated (as opposed to the unvegetated dunes).

Most fires would not have a long-term impact – only severe fires that ignite the soil at depths. Very severe fires can sterilize the soil by killing off microbial and invertebrate organisms that break down plant litter. Fire can also volatilize certain soil nutrients; others are lost in small smoke particles. Increased runoff can remove soil and leach soluble nutrients (mostly nitrogen, but also potassium magnesium and calcium). The addition of ash to the soil generally increases the availability of nutrients in soils, which is beneficial.

On a longer time scale, that of centuries, during times of prolonged drought, this alternative may result in rare but large and severe wildland fires. These intense, hot fires could scorch both substrate and the forest, leaving large areas of soils unprotected during storm events. Substantial quantities of erosion and soil loss could occur on exposed, steeper slopes under these conditions.

Alternative 1 would lead to a limited amount of soil erosion and soil compaction. Soil erosion can occur in two principal ways from wildland fires, fire suppression, and fuel reduction activities. Both ways involve exposing or disturbing soils, especially soils on steeper slopes, to rainfall and runoff. Wildland fires can temporarily eliminate or reduce the protective vegetative cover and burn up duff and litter, thus exposing underlying soils to the direct impact of raindrops and allowing soil particles to be carried away in runoff as suspended sediments. Disturbed soils on steeper slopes are more vulnerable to runoff, and tend to be thinner, so damage to soils and the vegetation they support on these sites is longer-lasting.

Fire suppression techniques, such as cutting firelines down to mineral soil or using heavy equipment like bulldozers, cause even more intensive disruption to the surface soil layer. However, these cover a much smaller area than the total acreage burned. Moreover, NPS policy requires the use of Minimum Impact Suppression Tactics (MIST), which further reduces the area of directly-disturbed ground surface. MIST relevant to protecting soils include the following:

- Cold trail the fire-edge when practical (a method of controlling a partly dead fire edge by carefully inspecting and feeling with the hand for heat to detect any fire, digging out every live spot, and trenching any live edge).

- Wetlines, or environmental lines, will be used wherever possible in lieu of handline construction if water and pumps are available. Waterbars will be constructed on handlines on steep slopes.

- Utilize soaker hose or foggers in mop-up. Avoid "boring" and hydraulic action on shallow soils. Boring is the use of a straight stream nozzle under high pressure during mop up phases of a fire to basically dig and mix up the hot coals along with the soil; in shallow soils this can literally wash the soil right off the bedrock.

- Firelines will be kept to the minimum width necessary to allow backfiring or safe blackline to be created. Utilize natural barriers wherever possible to avoid "tunnel effect" (the unnatural, unsightly appearance of a tunnel because of cleared undergrowth and vegetation along a relatively straight line).

- Bulldozers, graders and other large earth-moving equipment will not be used except when authorized by the park superintendent in emergency situations.

Another impact to soils from suppression activities is compaction from the use of heavy equipment like bulldozers and graders. Compaction harms soil structure, can increase runoff, and reduce the ability of soils to support vegetation. This impact would be localized, and overall, the quantity of soils that would be compacted under Alternative 1, in the context of the park as a whole, would be negligible.

The use of fire retardants and foam suppressants is not expected to result in any appreciable soil contamination. However, since fertilizers are an ingredient of fire retardant chemicals, their application to a site is comparable to the light application of a nitrogen fertilizer (Hamilton et al., no date). Overall, in the context of the park as a whole, this effect would have short-term, localized and negligible to minor effects on soils.

Alternative 2 – Suppress All Wildland Fires But Permit Prescribed Fire

Alternative 2 would have a negligible impact on the park's geologic features and values. It would likely, however, generate long-term, localized, minor impacts on soils in the park. The overall effect of this alternative would be to disturb soils on some sites on a more frequent, regular basis than in Alternative 1, but to a smaller extent.

Allowing for the use of prescribed fire would have the effect of controlling fuels accumulation and diminishing the possibility of the rare, but intense, fire event that would tend to severely impact on soils at the burn site. Prescribed fires would burn at a lower temperature and not penetrate as deeply into the soil, so that effects on soil organic matter and nutrients would not be as great. There should be little soil erosion associated with prescribed fires in grasslands, due to the ability of grass roots to stabilize soil (Wright and Bailey, 1982). Overall, Alternative 2 would spread out and moderate the effects of fire on the soils of any given site. In the long run, impacts on soils would be localized, short-term, and negligible.

Alternative 3 – Suppress All Wildland Fires on Mainland, Allow WFU on Manitou Islands, Permit Prescribed Fire (*Preferred Alternative*)

This alternative would generate impacts most similar to those of Alternative 2. Alternative 3 would have a negligible impact on the park's geologic features and values. It would likely generate long-term, localized, negligible to minor impacts on soils in the park.

On a year-to-year basis, there would be greater impacts on soils with this alternative than in the No Action Alternative, because of the use of prescribed burns. However, these impacts would still be short-term, localized, and negligible to minor. Moreover, the use of prescribed fire would cause minimal disturbance to soils on a regular basis, rather than on a less frequent but more destructive basis, as would be the case with waiting for naturally-ignited wildland fires to pass through an area.

In recent decades, very few of the lakeshore's fires have been naturally caused, a possible reflection of the relatively limited or infrequent role naturally-ignited fires may have exercised in this high-humidity ecosystem prior to human intervention (both by American Indians and later Euro-American settlers). Thus, allowing for WFU on the Manitou Islands may not substantially change the need to introduce prescribed fire there if habitat management and noxious weed control objectives are to be met.

Cumulative Impacts

There are no other reasonably foreseeable actions affecting the park's geology and soils in the future, to which the impacts of these alternatives would be added. None of the alternatives discussed above would be likely to result in or contribute to adverse, cumulative impacts, such as soil degradation or disappearance, over the short or long term. Soil formation processes would continue to take place under each alternative, so that soils are regenerated adequately. The appearance, structure and stability of dunes and beaches will continue to be shaped primarily by weather, wind, and erosion rather than fire cycles.

Conclusion

The FMP alternatives discussed above would have impacts on the park's soils ranging from negligible to possibly moderate. Their extent would be localized. Each alternative would involve some degree of disturbance of the park's soils; the primary distinction between the alternatives is regular, smaller disturbances (Alternatives 2 and 3) on a shorter time scale vs. irregular, less frequent but probably more destructive disturbances (Alternative 1).

None of the alternatives would impair geologic and soil resources or values that are (1) necessary to fulfill specific purposes identified in the enabling legislation of Sleeping Bear Dunes National Lakeshore, (2) key to the natural or cultural integrity of the park or opportunities its enjoyment, and (3) identified as a goal in the park's General Management Plan or other National Park Service planning documents.

4.2.2 Water Resources

Methodology for Assessing Impacts

The study team qualitatively assessed impacts to water resources by means of reviewing literature and applying professional judgment and experience with water resources (quality and quantity) to the particular hydrologic conditions of Sleeping Bear Dunes National Lakeshore. There would be no impairment of water resources in the park as a result implementing any of the alternatives.

Alternative 1 – No Action (Suppress All Wildland Fires and Exclude Prescribed Fire)

In the recent past wildland fires have affected a relatively small area of the park. Thus, the expected extent of impacts from the No Action Alternative would be relatively small, but extreme droughts could increase the affected area.

Implementing Alternative 1 would produce impacts that are short–term, localized and minor to moderate in intensity. Impacts from any one wildland fire or suppression effort on water quality would tend to be short-term, localized and minor to moderate in intensity.

The two principal impacts to water quality stem from: 1) erosion-induced suspended sediments, turbidity, and sedimentation, and 2) toxic effects from fire retardants and foam suppressants. In addition, intense fires may introduce large quantities of organic material (ash) into aquatic systems, blown in by wind or transported by runoff.

Increased soil erosion can result from loss of vegetative cover during a fire as well as from ground crews engaged in suppression activities. These could lead to turbidity and sedimentation of surface water resources in the park, both in streams and lakes. Turbidity and sedimentation can alter the hydrologic regime of surface waters and adversely impact aquatic habitats, invertebrates and fish. Diligent adherence to MIST as discussed under Section 4.2.1 above would reduce water quality problems from suppression efforts. However, a large, intense fire – which has a small but non-zero possibility of occurring under this alternative – has a high probability of resulting in short-term, localized, moderate to major adverse impacts on water quality from erosion, turbidity and sedimentation.

The use of fire retardants and/or foams could potentially cause significant temporary to short-term impacts to water quality and aquatic life if misapplied or mishandled (USDA Forest Service, 2000a). Retardants contain ammonia and phosphate or sulfate ions, which can change the chemistry of a water body, thus making it temporarily lethal to fish and other aquatic organisms; the principal toxic component of retardant chemicals in aquatic systems is ammonia (Adams and Simmons, 1999). Foams contain detergents that can interfere with the ability of fish gills to absorb oxygen. The degree of impact would depend on the volume of retardant/foam dropped into the water body, the size of the water body, and the volume of flow in the stream or river. For example, if a 800-gallon drop is made into a fast flowing river, it is likely that the lethal effects to aquatic resources would be short-lived as dilution below the toxic level is quickly achieved. On the other hand, a 3,000-gallon drop in a stagnant pond would likely cause toxic levels to persist for some time (USDA Forest Service, 2001).

After an extensive review of the literature, the USEPA published a regulation (40 CFR Ch. 1, 122.27 – 122.3) that deemed the use of retardants and foam suppressants in firefighting as a Cataclysmic Release. This ruling views their use as a necessary tradeoff in order to prevent the greater destruction of aquatic ecosystems from fire-caused silting, suspended solids and pH changes, than the possible loss of fish from an inadvertent retardant drop into a water body (USDA Forest Service, 2000a). The USEPA Office of the General Council reviewed this ruling and concurred that fire retardants and foams are neither subject to Point Source Regulations nor the National Pollution Discharge Elimination System (NPDES) procedures under the Federal

Clean Water Act. Nevertheless, scientific studies state unequivocally that direct application of fire retardant to waterways should be avoided.

Therefore, this alternative (and all of the others) incorporates the following special restrictions with regard to aerially applied retardant and foam use:

Retardant – No retardant drops within 400 feet (120 m) of open water.

Foam (aerial delivery) – Aerial delivery of foam requires Park Superintendent approval on a case-by-case basis. When approved, the following guidelines apply:

- Foam concentrate will only be injected into the holding tank after the water pick-up operation has been completed.
- Drops from Beaver, T2 and T3 helicopters – no drops within 200 feet (60 m) of open water.
- Drops from Scoopers, heavy air tanker or heavy helicopter – no drops within 400 feet (120 m) of open water.

Foam (ground delivery with motorized pumps):

- No application within 25 feet (8 m) of open water when using small pumps.
- No application within 50 feet (15 m) of open water when using Mk III or equivalent pumps.
- All foam concentrate used for injection will be located in impermeable containment basins, i.e. visqueen (plastic sheet) spread over rocks or logs to form a catch basin.

Foam (ground delivery with backpack pumps):

- No application within 10 feet (3 m) of open water.
- All backpack pumps will be filled a minimum of 10 feet (3 m) from open water. A separate, uncontaminated container must be used to transport water from source to backpack pump. This container must be kept uncontaminated by concentrate.

Diligent adherence to these measures would reduce the chance of adverse effects on water quality from the use of chemicals to suppress fires. However, there always exists the possibility of an accidental spill or aerial delivery of fire retardant, foam suppressant, or other hazardous material such as gasoline, directly into water bodies.

Another short-term impact of fires, particularly severe ones, on water quantity as well as quality is likely to be increasing the peak of the hydrograph within a given fire-impacted watershed until vegetative cover is able to re-establish itself. That is, the pulse of water flow through the hydrologic system would increase, as a result of decreased infiltration and absorption of rainfall into duff, litter and soil. Therefore, the runoff rate increases. This greater volume and velocity of flowing waters could potentially cause some scouring in streams and a temporary to short-term increase in turbidity and sedimentation.

Alternative 2 – Suppress All Wildland Fires But Permit Prescribed Fire

Implementing Alternative 2 would produce impacts that are short–term, localized and minor to moderate in intensity. Impacts from any one prescribed fire or suppression effort on water quality would tend to be short-term, localized and negligible to minor in intensity.

Alternative 2 would likely differ from the No Action Alternative (#1) by inducing more localized, minor impacts on water quality in any given year due to a program of prescribed fires across much of the lakeshore, both on the island and the mainland. However, this would thereby reduce the risk of more widespread and/or more severe impacts on water quality that are likely to occur when larger, more severe wildland fires with greater quantities of fuels to consume sweep across the park landscape, as compared to Alternative 1.

Alternative 3 – Suppress All Wildland Fires on Mainland, Allow WFU on Manitou Islands, Permit Prescribed Fire (*Preferred Alternative*)

Impacts of this alternative on water resources would be comparable to those of Alternative 2. Implementing Alternative 3 would produce impacts that are short–term, localized and minor to moderate in intensity. Impacts from any one prescribed fire on water quality would tend to be short-term, localized and negligible to minor in intensity. Impacts from any one wildland fire (either WFU or unwanted wildland fire) or suppression effort on water quality would tend to be short-term, localized and minor to moderate in intensity.

Alternative 3 would likely differ from the No Action Alternative by inducing more localized, negligible to minor impacts on water quality in any given year from a greater rate of prescribed fires. However, this would thereby reduce the risk of somewhat larger or more intensive impacts on water quality that are likely to occur when larger, more severe wildland fires with greater fuels to consume sweep across the park landscape, as compared to Alternative 1.

Cumulative Impacts

As discussed in Chapter 3, in Section 3.1.3, water quality in the park is generally good. In the area as a whole, outside the Lakeshore, long-term population growth and development will cause certain impacts on water resources. These may include more pronounced pulses in stream flow during storm events (from the growth in the area of impervious surfaces), with possible rises in localized flooding and streambank erosion and scouring as a consequence, leading to localized turbidity, suspended solids, and sedimentation. Other likely effects, based on widespread experience around the country, include increases in non-point source (i.e. from dispersed sources) pollution of both toxic and conventional contaminants. The three alternatives would not contribute appreciably to significant adverse cumulative impacts on the park's water quality.

Conclusion

Each of the FMP alternatives discussed above would have certain impacts on the park's water resources, more so on water quality than water quantity (hydrology and flow patterns). Both fires and suppression actions would potentially affect water quality, the former from erosion and turbidity due to loss of vegetative cover and soil disturbance, the latter from possible temporary

to short-term toxic effects of firefighting chemicals (retardants and foams) if dropped inadvertently into streams or lakes, as well as some erosion.

These impacts would range from negligible to moderate in intensity; in the case of any given fire or suppression action, they would tend to be short-term and localized. Looking at the park as a whole, these impacts would be long-term, but dispersed throughout the park's surface waters. The impact of any given prescribed burn is likely to be temporary to short-term, localized and negligible to minor. Larger wildland fires can affect more surface waters and affect them more negatively.

By attempting to suppress all fires, Alternative 1 would avoid relatively small year-to-year effects on water quality from prescribed fires and wildland fire use, but at the cost of increased risk of rare but severe fires that would have a much more severe, potentially regional, and longer-lasting impact on water quality, aquatic habitat, and aquatic organisms from severe erosion, turbidity and sedimentation. Nevertheless, none of the alternatives would permanently impair the park's water resources.

None of the alternatives would impair water resources or values that are, (1) necessary to fulfill specific purposes identified in the enabling legislation of Sleeping Bear Dunes National Lakeshore, (2) key to the natural or cultural integrity of the park or opportunities its enjoyment, and (3) identified as a goal in the park's General Management Plan or other National Park Service planning documents.

4.2.3 Floodplains and Wetlands

Methodology for Assessing Impacts

The study team qualitatively assessed impacts to floodplains and wetlands by examining the hydrologic features and processes of the park, the distribution of streamcourses, developed areas, lakes, and wetlands, and comparing these with the predicted effects of wildland and prescribed fires, fire management activities, and fire suppression efforts. The general procedures outlined in DO #77-1 (NPS, 1998b) and the NPS Procedural Manual for Wetland Protection (NPS, 1998c) were followed. There would be no impairment of floodplains and wetlands in Sleeping Bear Dunes National Lakeshore from implementing any of the alternatives.

Alternative 1 – No Action (Suppress All Wildland Fires and Exclude Prescribed Fire)

In the recent past wildland fires have affected a relatively small area of the park. Thus, the expected extent of impacts from the No Action Alternative would be relatively small, but extreme droughts could increase the affected area.

Alternative 1 would result in generally negligible to minor and localized impacts on floodplains and the functions and values of wetlands in the park. As indicated in the previous two sections, fires, especially large, intense fires, can increase the rate of runoff by stripping vegetative cover and disturbing soils. This in turn can raise the peak of the hydrograph of streams in affected watersheds, that is, increasing the volume and velocity of waters flowing in streams during and immediately

after storm events. This pulse of water can then produce some level of flooding, scouring, streambank erosion, and sedimentation.

By prohibiting wildland fire use and prescribed fire, on a year-to-year basis, Alternative 1 would generally avoid smaller-scale, less intense fires that might have resulted in downstream flooding in those streams flowing through the burned area. However, by facilitating fuel accumulation and the possibility of infrequent but more severe wildland fires, Alternative 1 may occasionally bring about greater downstream, localized flooding.

Wetlands located downstream of infrequent, large, severe fires – which this alternative at least partially attempts to avoid – could potentially be altered as a result of sediment deposition. Such deposition could smother certain emergent plants and at least subtly alter the character of the wetland over the long-term, but likely not permanently.

Alternative 2 – Suppress All Wildland Fires But Permit Prescribed Fire

Alternative 2 would also have effects on floodplains and wetland functions and values largely comparable to those of Alternative 1 – generally negligible to minor. Through use of prescribed fire, these effects would probably be more dispersed through time rather than concentrated in the immediate aftermath of a large, severe fire (which has a greater chance of happening under Alternative 1 than Alternatives 2 and 3).

Alternative 3 – Suppress All Wildland Fires on Mainland, Allow WFU on Manitou Islands, Permit Prescribed Fire (*Preferred Alternative*)

Alternative 3 would have effects on floodplains and wetland functions and values largely comparable to those of Alternative 2 – generally negligible to minor. Through WFU on the Manitou islands and greater use of prescribed fire on the islands and mainland, these effects would probably be more dispersed through time rather than concentrated in the immediate aftermath of a large, severe fire (which has a greater chance of happening in Alternative 1 than Alternatives 2 and 3).

Cumulative Impacts

No other reasonably foreseeable, future projects within the park or outside its borders upstream are known that would combine with any of the three above alternatives to generate significant cumulative impacts on floodplains and wetlands.

Conclusion

Impacts to floodplains and wetlands from each of the three alternatives would generally be negligible to minor. Under Alternative 1, rare but severe fires could lead to equally rare but potentially damaging flooding and some impacts to wetlands (from sedimentation), although most flooding would not damage property or costly improvements due to the undeveloped nature of most floodplains within and adjacent to the park. Many of the Lakeshore's streams drain directly to Lake Michigan or the inland lakes.

None of the alternatives would impair floodplains and wetlands or values that are, (1) necessary to fulfill specific purposes identified in the enabling legislation of Sleeping Bear Dunes National Lakeshore, (2) key to the natural or cultural integrity of the park or opportunities its enjoyment, and (3) identified as a goal in the park's General Management Plan or other National Park Service planning documents.

4.2.4 Air Quality

Methodology for Assessing Impacts

Impacts to air quality were qualitatively assessed by means of a review of the literature and pertinent laws, guidance and regulations, consultation with experts and regulators, professional judgment, and experience with comparable actions.

General Impacts and Mitigation Measures

The discussion in the following paragraphs and the mitigation measures below apply to each of the three FMP alternatives.

Michigan does not have specific visibility regulations, and its air pollution rules that relate to fire are aimed at protecting the public from the nuisance of smoke as much as the health or aesthetic effects. Open burning regulations (http://www.dnr.state.mi.us/pdfs/forestry/airrule.htm) permit the burning of "trees, logs, brush, and stumps..." in remote areas provided the fire does not become a nuisance. To that end, MDNR has requested that the NPS notify them when prescribed fires will be in progress (Alternatives 2 and 3), and they reserve the right to order the park to shut down a fire if it generates smoke-related complaints that can not be resolved.

(1). Notification Procedures.
- Wildland fires: no notification required
- Planned prescribed fires (Alts. 2 and 3): NPS will send a copy of burn plan to DNR at least two weeks in advance of fire (preferably more).
- WFU's: NPS will notify by telephone first full business day after decision to not suppress. Follow up with letter as soon as practical stating reason for the fire.

(2). Approvals – In all cases, MDNR will notify the NPS in writing or by telephone of their ruling. In most cases, approval will be routine, provided that smoke is not expected to adversely impact people. MDNR will not grant permission for a fire that generates complaints if the NPS is unable to mitigate the problem either by reducing emissions or smoke residence in sensitive areas or by assisting people to get away from impacted areas.

Lakeshore management needs to recognize areas where smoke problems are likely and take steps to notify visitors and/or mitigate the smoke intrusion.

At Sleeping Bear Dunes, the notification process will be part of the public information and interpretation program outlined in Section X of the FMP. Information on the objectives of the

park fire management program will be explained to visitors and residents exposed to smoke from any fires.

Smoke management guidelines produced by the US Forest Service recommend identifying all sensitive areas downwind of and within 10 miles for backing fires, 20 miles of head fires or large burns (over 250 acres), or 30 miles for logging debris or slash fires. Since there are no logging operations at Sleeping Bear Dunes, only targets within 20 miles will be identified. There are numerous small communities east of the mainland unit that are subject to smoke impacts. From the islands there are fewer targets because of the distance from the mainland shore.

Within the mainland FMU, developed areas at Platte River, D.H. Day and backcountry camp sites commonly have between 50 and several hundred people in residence. Other sensitive receptors are life estates and inholdings. Any or all of these targets could be affected by smoke produced from fires at Sleeping Bear Dunes, although past history suggests that the frequency of smoke events is extremely low. Areas most likely to be impacted by smoke are those within a thirty-degree radius of the path of any smoke plume and within the specified distances for the type and size of the fire. Critical targets of special concern are those that are within ¾ of a mile of the plume.

Most of the problems associated with fire emissions are caused by particulates. Smoke that remains near the ground from a smoldering fire is more likely to be a problem than the interception of smoke plumes. Depending on the season, smoke particles may serve as the nuclei for fog development, smoke-generated fog may cause dangerous visibility problems along roads on the mainland.

Lakeshore management would adopt the following strategies to mitigate air quality and smoke impacts:

(1). Prescribed fires (Alts. 2 and 3 only) and WFU's (Alt. 3 only) – Fires to improve resource values will have a smoke dispersion component in the prescription. If smoke creates a prolonged hazard or significant nuisance, appropriate actions will be taken to mitigate the condition causing the problem or the fire will be suppressed.

(2). Suppression – Suppress or mop up smoldering fuels when they are likely to generate smoke management concerns.

(3). Ignition – Ignite smoldering fuels to get them to burn with an active flame, which generates less than half the emissions of smoldering combustion (NWCG, 1985). Flaming combustion also generates convection columns, which raise smoke above ground level.

(4). Types of Fires – Use backing fires when possible.

(5). Dispersion – Recognize poor dispersion conditions that will last several days, such as the predicted passage of a slow-moving warm front; a lingering high pressure system with stable atmosphere; or high humidity conditions, and adjust burning strategies as necessary.

(6). Residual Smoke – When a fire has burned for an extended period of time and generated a lot of residual smoke, the NPS will consider suppressing all new starts to minimize additional smoke production.

(7). Firefighter Safety – During high smoke production phases of a fire suppression operation, crews will be rotated out of high smoke areas.

(8). Sensitive Areas – Prescribed fire ignitions in sensitive areas will be done either when visitation is low, or the Superintendent will restrict entry to areas potentially impacted by smoke.

Alternative 1 – No Action (Suppress All Wildland Fires and Exclude Prescribed Fire)

In the recent past wildland fires have affected a relatively small area of the park. Thus, the expected extent of impacts from the No Action Alternative would be relatively small, but extreme droughts could increase the affected area.

By suppressing all wildland fires over a period of decades, which was the policy of the NPS and other Federal agencies during most of the 20th century, the park may actually be facilitating the accumulation of fuels. However, the fire history of the surrounding area, on the eastern shore of Lake Michigan, is not known with enough certainty to be able to predict the fate of these accumulated fuels and whether they could simply decompose in place on the forest floor rather than being consumed by fire. However, in all likelihood there is a non-zero probability that under some scenarios extreme weather conditions would eventually occur, resulting in a destructive wildland fire which suppression efforts would be unable to control at first. When that happens, a major air pollution episode would occur that could last some days, with potentially significant violations of the NAAQS.

In a typical year, Alternative 1 would result in temporary, regional, minor adverse impacts on air quality. The magnitude of nuisance and adverse health effects from fire-generated smoke on local residents and park visitors would be negligible to minor. Since large, severe fires may occasionally occur under this alternative on a time scale ranging from multiple decades to centuries, at these times Alternative 1 could result in temporary, moderate impacts on regional air quality. At such times, smoke generation would probably be severe, if localized and temporary, causing nuisance and adverse health effects on local residents and park visitors. Adverse effects on both residents and park visitors would be mitigated and minimized by appropriate evacuation efforts.

Alternative 2 – Suppress All Wildland Fires But Permit Prescribed Fire

Alternative 2's impacts on air quality would differ from those of Alternative 1, because emissions would likely be even more dispersed over time due to the use of prescribed fire for habitat management and hazard fuel reduction. The long-term probability of a severe, uncontrollable wildland fire occurring in the park would be smaller than in Alternative 1. The general mitigation measures mentioned above would be used, in addition to the guidelines listed below. Impacts on air quality from any given prescribed burn would likely be temporary, localized and negligible to minor. Overall, Alternative 2's impacts would tend to be long-term, localized to regional, and minor.

Guidelines – The following are the management guidelines for all phases of the fire management program under Alternative 2:

- No prescribed fires will be ignited during air pollution alerts, temperatures inversions or when a burn ban has been established by any local government.
- Fire weather forecasts will be used to predict smoke dispersal.
- Burning will be done only when conditions result in rapid smoke dispersal.
- Proper firing techniques to lower smoke production will be utilized.
- Timing of prescribed fires will occur after 9:00 am with ignition ending before 4:00 p.m. whenever possible.
- Smoke projection maps will be prepared to assist in projecting smoke dispersal patterns.
- Local police and fire agencies will be notified of any planned prescribed fire so they may provide any needed assistance with traffic flow should problems with smoke dispersal occur.
- Prescribed fires will be planned and conducted when proper wind flow will disperse smoke over unpopulated or low density populated areas.
- Prescribed fires will strive not to violate Federal Clean Air Act standards.

Alternative 3 – Suppress All Wildland Fires on Mainland, Allow WFU on Manitou Islands, Permit Prescribed Fire (*Preferred Alternative*)

Alternative 3 would have impacts more or less equivalent to those of Alternative 2. In a typical year, it would result in short-term, local to regional, negligible to minor adverse impacts on air quality. By expanding the use of prescribed fire, and allowing for WFU on the Manitou Islands, this alternative would tend to spread smoke emissions out over more years instead of concentrating them in the years when wildland fire use and unwanted wildland fires are prevalent. It would also reduce the long-term likelihood of severe wildland fires and the much greater emissions associated with those.

The mitigation measures or guidelines listed for Alternative 2 would also be followed in this alternative.

Cumulative Impacts

As mentioned in Section 3.1.5 (Affected Environment section for air quality), the Lakeshore is located in a Class II area, with generally high air quality. Although automobile emissions are projected to grow as a result of long-term population growth along the eastern shore of Lake Michigan, and there may be some increase in smoke from growing use of prescribed fire in Michigan and neighboring states, the expected emissions from prescribed fire, wildland fire use and unwanted wildland fires at the Lakeshore are small enough that they will not contribute significantly to any cumulative air quality degradation in the airshed.

Conclusion

Individual fires, whether prescribed fires, wildland fires for resource benefits, or unwanted wildland fires, depending on their size and severity, would generate impacts on air quality that range from temporary to short-term, localized to regional, and negligible to moderate. Two of

the three FMP alternatives that implement prescribed fire would generate more consistent impacts on air quality from year to year; these impacts would generally be temporary, localized and minor. They would also tend to occur at times (spring and fall) that avoid peak visitation periods.

Alternative 1, which suppress all fires, would in most years produce fewer emissions and smoke than Alternatives 2 and 3. However, as fuels accumulate, it seems probable that sooner or later, extreme weather conditions, perhaps several times in a century, might trigger severe fires that could have a moderate impact on regional air quality, and major impacts on local air quality, for a number of hours, days, or even a week or more.

The implementation of Alternatives 2 and 3 would not impair air resources and related values that are, (1) necessary to fulfill specific purposes identified in the enabling legislation of Sleeping Bear Dunes National Lakeshore, (2) key to the natural or cultural integrity of the park or opportunities its enjoyment, and (3) identified as a goal in the park's General Management Plan or other National Park Service planning documents.

In contrast, during most years, Alternative 1, because of its lack of prescribed fire and wildland fire use, would actually produce less smoke and thus better air quality and visibility than Alternatives 2 and 3. The tradeoff, however, is that perhaps once or several times a century, the full suppression alternatives could possibly result in large, severe fires that might overwhelm suppression efforts and generate moderate to major impacts on local (and to some extent regional) air quality and significant air pollution episodes for nearby residents.

4.2.5 Vegetation

Methodology for Assessing Impacts

Impacts to vegetation from the alternative FMPs were qualitatively assessed by means of a literature review of forest and fire ecology in the region, and consultation with foresters, botanists and fire specialists. Under Alternatives 2 and 3 there would be no impairment to vegetation in Sleeping Bear Dunes National Lakeshore; Alternative 1 may lead to impairment.

Alternative 1 – No Action (Suppress All Wildland Fires and Exclude Prescribed Fire)

In the recent past wildland fires have affected a relatively small area of the park. Thus, the expected extent of impacts from the No Action Alternative would be relatively small, but extreme droughts could increase the affected area.

Over the next five years, Alternative 1 is likely to lead to long-term, local, minor adverse effects on vegetation communities, as judged by the park's resource and vegetation management goals. The longer fire is successfully excluded from Sleeping Bear Dunes by aggressive suppression efforts, the longer fire-intolerant species would have to continue to gradually supplant native, fire-adapted and fire-dependent species, so that vegetation communities at the Lakeshore would become increasingly less "natural." In some national parks and in many parts of the country where fire ecology is better understood – and where fire may exercise a greater role in nutrient recycling and as an agent of disturbance (interrupting community succession), the adverse effects

of complete fire exclusion can be predicted with more certainty and specificity than at the Lakeshore. Nevertheless, as a general rule, management intervention to prevent all perturbations in an ecosystem, even natural ones like fire, often leads to unanticipated and undesirable outcomes.

The use of fire retardants under this alternative (and all others) during active suppression efforts could have short-term, localized effects on vegetation in the vicinity of a fire as a result of the nitrogen-fertilizing properties of the retardant (Hamilton, et al., no date). If conditions are sufficiently moist, increased growth would likely occur during the growing season in which the chemical is applied, but this effect would not persist. Under drier conditions, there would likely be no increased growth or biomass production. Weedy or exotic species able to exploit the additional nitrogen more effectively may gain a temporary advantage at the expense of more desirable native plants, especially under moist conditions.

Under alternative 1, intensive, stand replacement fires would potentially expose large areas of mineral soil, which would act as a favorable seed-bed to establishment and spread of non-native/exotic plants.

Alternative 2 – Suppress All Wildland Fires But Permit Prescribed Fire

Alternative 2 would use prescribed fire for both fuel reduction and habitat management purposes. Its use would encourage the growth of beneficial forest understory species and the regeneration of fire-adapted and fire-dependent species, at the expense of fire-intolerant species that have proliferated in recent decades. It would also help control or mitigate insect and disease attacks by consuming the diseased and dead wood that are most vulnerable to insects and plant pathogens. Over time, it would lead to rejuvenated rather than decadent forests and promote a healthier diversity of forest age classes. Alternative 2's impact on vegetation would be long-term, local, and minor to moderately beneficial.

However, it appears that the prescribed fire program contemplated under this alternative would only partially address the problem of nuisance, weedy and exotic plants at the Lakeshore. For example, based on experience elsewhere, control of invasive garlic mustard populations using only prescribed fire appears to be difficult. With regard to another prominent non-native plant, leafy spurge, fire removes only the above-ground part. Some individuals are able to survive prescribed fires if they are not hot enough to kill underground roots. However, prescribed fire used in conjunction with herbicides can provide good control. For purple loosestrife, the use of fire as a control measure has largely has been dismissed as ineffective. This is probably due, in good part, to the wet soil conditions where it occurs, combined with a well-protected rootstock from which it produces annual stem growth. Attempts to burn residual biomass following cutting or herbicide treatments of purple loosestrife, to the extent that material will actually ignite, may merely result in recruitment of purple loosestrife seedlings due to exposure of bare substrate containing a well-endowed seed (Fire Sciences Laboratory, 2002). Since fire tends to have mixed results in controlling most of the invasive or exotic species of concern in the park, Alternative 2 would not be particularly helpful in pursuing this resource management objective.

Alternative 3 – Suppress All Wildland Fires on Mainland, Allow WFU on Manitou Islands, Permit Prescribed Fire (*Preferred Alternative*)

Alternative 3's impacts on vegetation would be most similar to those of Alternative 2: local, regional, and minor to moderately beneficial. Species composition and vegetation community structure would be nudged back toward conditions that more closely approximate natural communities. Allowing WFU on the Manitou islands would restore the role of fire as an agent of disturbance and a natural regenerative force in these areas, but as a practical matter, due to the low incidence of naturally-ignited fire, the outcome for vegetation communities may not differ much from Alternative 2. Effects on non-native, invasive species and noxious weeds would be similar to the effects of Alternative 2 – partially effective in controlling them, and most successful when used in conjunction with other methods like use of selective herbicides or mechanical removal.

Cumulative Impacts

Alternative 1, the complete suppression alternatives, would continue to build upon the prior cumulative effects of the better part of a century of fire suppression on vegetation community structure, age class, and composition. Alternatives 2 and 3, in contrast, represent a break from the results of the unnatural suppression approach to fire management.

Throughout the expanded region of northern temperate forests, mixed forests, and boreal forests that includes northern Michigan, as well as in the rest of North America, there tends to be beneficial cumulative impacts on the forest resource related to the more realistic assessment of the ecological role of fire and its potential as a habitat management tool that are now prevalent among resource managers. Increasing use of prescribed fire and wildland fire use in the northern Midwest in both forest and grassland habitats reflects this new understanding.

Conclusion

Impacts to vegetation from all alternatives would be long-term in duration and local in extent. Over the next five years, Alternative 1 would likely result in minor adverse impacts on the park's vegetation communities. If Alternative 1 were to be continued beyond the life of the plan, these impacts could well worsen to moderate in intensity. Alternatives 2 and 3 are both likely to result in beneficial impacts to vegetation, as gauged by the success in pursuing the park's vegetation and resource management goals and objectives.

Implementation of Alternatives 2 and 3 would not impair vegetation and related values that are, (1) necessary to fulfill specific purposes identified in the enabling legislation of Sleeping Bear Dunes National Lakeshore, (2) key to the natural or cultural integrity of the park or opportunities its enjoyment, and (3) identified as a goal in the park's General Management Plan or other National Park Service planning documents.

In contrast, Alternative 1would perpetuate existing trends in the park's vegetation community types and successional patterns. Over the long term, it would likely result in adverse impacts of minor to moderate intensity, which could be regarded as an impairment of the park's vegetation resources. But even these conditions would not persist indefinitely, because over the coming

decades one or more severe wildland fires might well be triggered under this alternative and that would lead to abrupt or even devastating changes in the park's forest communities. At first, such stand-replacement fires would be perceived as negative, but viewed in a larger context, they can be restorative and therapeutic for the forest.

4.2.6 Wildlife and Fisheries

Methodology for Assessing Impacts

Impacts to wildlife and fisheries from the alternative FMPs were qualitatively assessed by means of a literature review of the effects of fire on wildlife habitat, consultation with biologists, and professional judgment. There would be no impairment to wildlife from Alternatives 2 and 3 and none of the alternatives would impair fisheries.

Alternative 1 – No Action (Suppress All Wildland Fires and Exclude Prescribed Fire)

In the recent past wildland fires have affected a relatively small area of the park. Thus, the expected extent of impacts from the No Action Alternative would be relatively small, but extreme droughts could increase the affected area.

The impact of Alternative 1 on wildlife would be long-term in duration, regional in extent, and probably minor adverse in intensity. With some exceptions – such as when accidental spills of toxic retardants into watercourses occur, which would be infrequently – impacts on fisheries would generally be negligible.

Under this alternative and each of the others, some wildlife, especially smaller or less mobile organisms, or those that are nesting on or near the ground (including young), would be subject to direct mortality from wildland fires, and to a smaller extent from suppression actions themselves. Overall, this direct mortality would be relatively inconsequential in terms of its effects on the viability of wildlife populations. Mechanical hazard fuel reduction would also cause a relatively negligible amount of direct mortality.

The most important impact of this alternative, and indeed, each of the others, on wildlife, would be indirect, via alterations in the habitats in which wild animals live and on which they depend. As a function of their size and intensity, fires change plant community composition and structure – setting back community succession – and in so doing, changing the types of food and cover available to wildlife. Food types and cover patterns determine to a large extent the species of fauna that can occur in any given area. Species native to this area are adapted to the particular fire regime that characterized its ecology prior to human intervention in the landscape. As noted earlier, the original fire ecology of the native vegetation communities in this part of Michigan is still somewhat speculative. Nevertheless, fires did occur and native wildlife has succeeded in coping with the effects of fire on habitat for millennia. Certain species of mammals and birds actually thrive in or even depend on the more open habitats dominated by young, vigorous plant growth that develop after fires, including annual and perennial forbs and grasses, as well as seedling and sapling shrubs and pioneering tree species.

Excluding fire from the Lakeshore (and elsewhere in the region) for the majority of the 20th century is generally regarded to have had somewhat negative effects on the diversity and abundance of native wildlife species, because these evolved with and are dependent on habitats that correspond to various post-fire successional stages. The primeval forest was characterized by a mosaic of plant communities of different age classes and successional stages (seres) created and maintained in part by fire and other natural agents of disturbance. This mosaic of habitats tended to support a diverse assemblage or community of wildlife.

In the future, at least through the five-year life of the FMP, this alternative would likely result in a continuing accumulation of fuels over most of the park, maturing or decadent forest stands, and an ongoing gradual decline in wildlife habitat values. However, at some point in the coming decades, at a precise time that cannot be predicted, a major fire or fires would probably occur under this alternative in spite of suppression efforts, reintroducing early successional stages across large portions of the park.

In general, this alternative (and all the others) would have negligible adverse impacts on the park's fisheries, as long as proper precautions (i.e. mitigation measures) are followed in the use of fire retardants during suppression efforts. Short-term toxicity tests have showed that both fire-retardant and foam-suppressant chemicals are highly toxic to aquatic organisms, including algae, aquatic invertebrates, and fish (Hamilton, et al., no date). The primary toxin in retardants is ammonia, while in foam suppressants it is the surfactant. If fire-fighters comply with the procedures and buffer zones listed in the FMP and Section 4.2.2 of this EA, adverse effects on the park's aquatic ecosystems should be avoided altogether.

Alternative 2 – Suppress All Wildland Fires But Permit Prescribed Fire

This alternative would likely yield long-term, regional benefits to wildlife habitat and populations by attempting to re-create over time the mosaic of vegetation communities and successional stages that existed in the park prior to logging, settlement, and fire suppression. Most species of native wild animals that occurred prior to human intervention in landscape processes would likely see population increases under the improved habitat conditions this alternative would foster. These changes would take decades to come to fruition; the process would still be in its initial stages during the lifetime of the new FMP. Habitat and wildlife benefits are likely to occur incrementally and somewhat predictably. As with all other alternatives, effects on fisheries would likely be negligible.

As with Alternative1, there would be negligible levels of direct wildlife mortality associated with wildland fires, prescribed fire, and fire suppression. This would have no long-term effect on the viability of wildlife populations.

Alternative 3 – Suppress All Wildland Fires on Mainland, Allow WFU on Manitou Islands, Permit Prescribed Fire (*Preferred Alternative*)

This alternative would have impacts on wildlife that are long-term, regional, and largely beneficial for wildlife. Its adverse impacts on fisheries (from the use of fire-fighting chemicals) are likely to be negligible.

By allowing the use of prescribed fire, as well as allowing for wildland fire use on the Manitou Islands, this alternative should make some progress towards restoring the ecological role of fire in the Lakeshore's natural communities. For reasons discussed above, most native wildlife species should benefit by the habitat changes and restored ecological niches that are likely to result from expanding the use of low-severity fires.

Cumulative Impacts

In the larger context, any number of projects and trends are underway, on geographic scales ranging from the local area to the hemisphere, that affect the health and viability of wildlife populations in the park. Some these trends are positive and some negative, and they concern such varied phenomena as different kinds of toxic contamination, habitat fragmentation in North America and habitat loss in Central and South America (affecting neo-tropical migrants), and evolving attitudes toward wildlife. The cumulative effect of habitat changes in the park to date, after a century that included large-scale logging, fire suppression, agriculture, habitat fragmentation, and expanding residential development in the area have been largely unfavorable to wildlife. Alternatives 2 and 3 would represent a modest effort to begin to reverse these largely negative trends. In contrast, Alternative 1 would probably perpetuate cumulative, adverse changes to habitat.

Conclusion

In the coming decades, Alternative 1 would likely be unable to prevent the continued development of habitat conditions that are largely unfavorable to wildlife. Alternatives 2 and 3, if implemented fully and successfully, should prove generally beneficial to most wildlife at the Lakeshore.

Thus, implementation of Alternatives 2 and 3 would not impair wildlife and related values that are, (1) necessary to fulfill specific purposes identified in the enabling legislation of Sleeping Bear Dunes National Lakeshore, (2) key to the natural or cultural integrity of the park or opportunities its enjoyment, and (3) identified as a goal in the park's General Management Plan or other National Park Service planning documents.

In contrast, Alternative 1 would probably perpetuate existing, unsatisfactory conditions and trends in the park's wildlife habitat. Over the long term, it would produce adverse impacts of moderate intensity, which could be regarded as an impairment of the park's wildlife resources. But this situation would not persist indefinitely, because one or more severe wildland fires would eventually be triggered under this alternative and lead to abrupt changes in perhaps extensive portions of the park's wildlife habitat. Initially, intense fires over a wide area would have very negative consequences for the park's wildlife, but over time, burned areas would be re-colonized by species that favor early successional stages of vegetation communities.

With regard to fisheries resources, implementation of any of the alternatives would not impair fisheries or related values that are (1) necessary to fulfill specific purposes identified in the enabling legislation of Sleeping Bear Dunes National Lakeshore, (2) key to the natural or cultural integrity of the park or opportunities its enjoyment, and (3) identified as a goal in the park's General Management Plan or other National Park Service planning documents.

4.2.7 Threatened and Endangered Species

Methodology for Assessing Impacts

Impacts to threatened and endangered species from the alternative FMPs were qualitatively assessed by means of a literature review of the effects of fire on these species, consultation with biologists and agencies, and professional judgment. Generally speaking, the conclusions of the previous section with regard to the effects of fire on wildlife also hold for the more specific case of listed species of flora and fauna. A number of species are fire-dependent, so that to the extent fire is reintroduced into the environment, this tends to be beneficial. To the extent fire continues to be excluded, this tends to be harmful.

Alternative 1 – No Action (Suppress All Wildland Fires and Exclude Prescribed Fire)

In the recent past wildland fires have affected a relatively small area of the park. Thus, the expected extent of impacts from the No Action Alternative would be relatively small, but extreme droughts could increase the affected area.

The impact of Alternative 1 on federal threatened and endangered species would be long-term in duration, regional in extent, and probably negligible in intensity.

As indicated in Section 3.1.8, four federal-listed species occur or could potentially occur at Sleeping Bear Dunes: the piping plover, bald eagle, Michigan monkey-flower, and Pitcher's thistle. In addition, designated critical habitat for the piping plover – nesting habitat – is also located in the park. The piping plover nests and forages along the shoreline, beaches, and sand dunes, that is, outside of vegetated areas, so it is unlikely to be directly affected by fires and fire suppression associated with Alternative 1. The fish-eating, shoreline-nesting bald eagle would also probably be largely unaffected. The Michigan monkey-flower grows in muck and sand that is either saturated or covered by cold, flowing spring water, near present or past shorelines of Lake Michigan. Occurring as it does such wet sites, it is unlikely to be affected by wildland fires. Pitcher's thistle grows on the beaches and grassland dunes along the Lakes Michigan shoreline, and is thus likely out of reach of the direct effects of intense fires.

In sum, with regard to the federal-listed species protected under the 1973 Endangered Species Act, Alternative 1 would likely result in the following impacts:

- Piping plover – no effect
- Piping plover critical habitat – no effect
- Bald eagle – may affect, but not likely to adversely affect
- Michigan monkey-flower – no effect
- Pitcher's thistle – may affect, but not likely to adversely affect

More than 30 state-listed species of native plants and animals may occur at the Lakeshore. Still other species have never been documented within the park per se, or in Leelanau or Benzie counties, but may possibly be found there in limited locales or during certain seasons. Some plant species may be fire-dependent for germination of seeds or survival of seedlings; certain animal species may depend on habitat or successional stages (seres) that only follow fire. Thus, this alternative, by

excluding fires over long periods of time, would probably have at least a minor effect on some of the state-listed species.

Under Alternative 1, extreme weather conditions coupled with fuel accumulation might someday trigger an intense wildland fire that is difficult to suppress and could result in severe damage to habitat and perhaps at least temporary impacts to populations of state-listed species. Such impacts could be short-lived or longer-term, depending on particular circumstances.

Under Alternative 1 the following mitigation measures would be implemented:

- Mechanical fuel treatments should not take place during active eagle nesting periods, and all hazard fuel reduction methods will not be any closer than 660 feet to an active eagle nest.

- Any fire that is judged to threaten an active bald eagle's nest would be managed to minimize risk.

- NPS will extinguish any wildland fires on North and South Manitou Island that might threaten any piping plover nests.

- Fire management staff will inform Chief of Natural Resources of unwanted wildland fire's suppression activities as soon as possible.

Alternative 2 – Suppress All Wildland Fires But Permit Prescribed Fire

This alternative, which would attempt to replicate the ecological role of fires with an energetic prescribed fire program, would likely yield modest long-term, regional benefits to wildlife habitat and populations in general and to threatened and endangered species in particular.

The impacts of Alternative 2's prescribed fire, wildland fires, and fire suppression activities on federal listed species protected under the 1973 Endangered Species Act are essentially the same as with the No Action Alternative:

- Piping plover – no effect
- Piping plover critical habitat – no effect
- Bald eagle – may affect, but not likely to adversely affect
- Michigan monkey-flower – no effect
- Pitcher's thistle – may affect, but not likely to adversely affect

In terms of the more than 30 state-listed species of native plants and animals that may occur at the Lakeshore, the prescribed burning associated with this alternative would tend to have more year-to-year impacts, both beneficial and adverse, on species' populations and distributions within the park, than with the No Action Alternative. While local populations of some plants and small animals could be adversely affected by prescribed fires, over the long term, species should benefit from fire. As stated above, some plant species may be fire-dependent for germination of seeds or survival of seedlings; certain animal species may depend on habitat or successional stages (seres) that only follow fire. For example, ground-nesting birds disturbed by fire can often re-nest later (Eliason,

2002). Thus, the fires permitted under Alternative 2 would not have serious negative consequences for native plants and animals. Overall, to the extent Alternative 2 allows for enough fires in the coming years to reverse decades-old habitat trends, it is predicted to have minor beneficial, long-term effects on state threatened and endangered species.

In Alternative 2, and Alternative 3 as well, all known bald eagle nests, sensitive plant locations, or any other listed species known to be present which falls within or in close proximity to prescribed burn units, would receive mitigation in prescribed fire burn plans to ensure they are not impacted.

Under Alternative 2 the following mitigation measures would be implemented:

- All bald eagle nests, sensitive plant locations, or any other listed species known to be present, which fall within or in close proximity to prescribed burn units, will receive mitigation in prescribed fire burn plans to ensure they are not impacted.

- Mechanical fuel treatments should not take place during active eagle nesting periods, and all hazard fuel reduction methods will not be any closer than 660 feet to an active eagle nest. In addition, prescribed fire will be excluded from these areas.

- Any fire that is judged to threaten an active bald eagle's nest would be managed to minimize risk.

- NPS will extinguish any wildland fires or wildland fire use on North and South Manitou Island that might threaten any piping plover nests.

- Prescribed fires for ecosystem management and hazard fuel reduction will not be ignited within any area known to harbor Pitcher's thistle and Michigan monkey flower.

- Fire management staff will provide Chief of Natural Resources with prescribed burn plans far enough in advance to allow survey of the area.

- Fire management staff will inform Chief of Natural Resources of unwanted wildland fire's suppression activities as soon as possible.

Alternative 3 – Suppress All Wildland Fires on Mainland, Allow WFU on Manitou Islands, Permit Prescribed Fire (*Preferred Alternative*)

Generally, this alternative would have impacts on threatened and endangered species that are similar to those of Alternative 2 – long-term, regional, and if it succeeds, largely beneficial. By expanding the use of prescribed fire, as well as permitting wildland fire use on the Manitou Islands, this alternative should make progress in the direction of restoring the ecological role of fire in the Lakeshore's natural communities. In sum, with regard to the federal listed species protected under the 1973 Endangered Species Act, Alternative 3 would likely result in the following:

- Piping plover – no effect

- Piping plover critical habitat – no effect
- Bald eagle – may affect, but not likely to adversely affect
- Michigan monkey-flower – no effect
- Pitcher's thistle – may affect, but not likely to adversely affect

Impacts on state-listed species are likely to be modestly beneficial over time.

Under Alternative 3, the same mitigation measures listed for Alternative 2 would be implemented, with one minor difference:

- All bald eagle nests, sensitive plant locations, or any other listed species known to be present, which fall within or in close proximity to prescribed burn units, will receive mitigation in prescribed fire burn plans to ensure they are not impacted.

- Mechanical fuel treatments should not take place during active eagle nesting periods, and all hazard fuel reduction methods will not be any closer than 660 feet to an active eagle nest. In addition, prescribed or WFU fire will be excluded from these areas.

- Any fire that is judged to threaten an active bald eagle's nest would be managed to minimize risk.

- NPS will extinguish any wildland fires or wildland fire use on North and South Manitou Island that might threaten any piping plover nests.

- Prescribed fires for ecosystem management and hazard fuel reduction will not be ignited within any area known to harbor Pitcher's thistle and Michigan monkey flower.

- Fire management staff will provide Chief of Natural Resources with prescribed burn plans far enough in advance to allow survey of the area.

- Fire management staff will inform Chief of Natural Resources of unwanted wildland fire's suppression activities as soon as possible.

Cumulative Impacts

As with vegetation and wildlife in general, a number of factors have had cumulative effects, largely negative in sum, on the viability of the populations of those organisms that are now listed as threatened or endangered species. These same factors, and others, perhaps climate change for example, would bear on the survival of these species in the future. The trends for some listed species are positive and for others, uncertain, mixed, or negative. There are no particular reasonably foreseeable future projects or actions that, in conjunction with the proposed action, threaten the continued existence of any given listed organism.

Conclusion

None of the alternatives would impair threatened or endangered species or related values that are, (1) necessary to fulfill specific purposes identified in the enabling legislation of Sleeping Bear Dunes National Lakeshore, (2) key to the natural or cultural integrity of the park or opportunities its enjoyment, and (3) identified as a goal in the park's General Management Plan or other National Park Service planning documents.

4.2.8 Wilderness

Methodology for Assessing Impacts

Impacts to wilderness were evaluated qualitatively by examining the letter and spirit of the 1964 Wilderness Act, making comparisons with fire management in other wilderness areas, such as the Boundary Waters Canoe Area Wilderness (BWCAW) of the Superior National Forest and proposed wilderness in Voyageurs National Park in Minnesota, and professional judgment and experience. None of the alternatives would significantly impact de facto wilderness and those portions of the park recommended by the NPS for formal protection under the Wilderness Act.

As noted in Section 3.1.9, there are five recommended wilderness areas on the Manitou islands and the mainland at the Lakeshore.

Alternative 1 – No Action (Suppress All Wildland Fires and Exclude Prescribed Fire)

In the recent past wildland fires have affected a relatively small area of the park. Thus, the expected extent of impacts from the No Action Alternative would be relatively small, but extreme droughts could increase the affected area.

Alternative 1 would have long-term, minor adverse effects on recommended wilderness within the park. This alternative would retain certain wilderness values – such as the appearance of wildness at most times and the absence of improvements and human inhabitants. Yet by actively excluding a critical natural force that shapes habitats and the landscape, Alternative 1 may be violating the spirit if not the letter of the Wilderness Act. In addition, the greater level of suppression activity that would occur under this alternative runs the risk of interfering both with the solitude and appearance of wilderness. When extreme conditions eventually trigger a large wildland fire in the park, the impact of both the fire on the landscape and intensive suppression activities on the integrity of the wilderness could be substantial.

Under this and every other alternative, suppression actions to control wildland fires may take place in the wilderness. The park must weigh values at risk, including human life, nearby improvements, wilderness values, habitat and wildlife values. Each alternative would require the use of hand power tools and Minimum Impact Suppression Tactics (MIST) within areas of recommended wilderness so as to minimize the effect of temporary human disturbances and intrusions. MIST measures are described in Section 2.6 (Mitigation Measures Common to Each Alternative).

Noise associated with fire suppression activity would probably last no more than a few days or weeks per decade, more or less. This would not represent a significant intrusion into the solitude of

wilderness, especially in the context of other artificial and mechanical sounds in the area emanating from land, lake, and air.

Alternative 2 – Suppress All Wildland Fires But Permit Prescribed Fire

Under this alternative, prescribed fire would be used in place of wildland fire use throughout the park, including the recommended wilderness areas. Alternative 2 would retain many wilderness values, such as the absence of improvements and human inhabitants, and the presence of high-quality habitat, wildlife, and landscapes in which "the imprint of man's work [is] substantially unnoticeable."

The philosophical conflict between this alternative and the "spirit" of wilderness is that it entirely replaces naturally-ignited wildland fires as a force in landscape and habitat modification with deliberately-set, human-managed prescribed fires. Thus, it does not allow natural forces to operate freely. Nevertheless, by proactively using and manipulating this force of nature, the "appearance" of the landscape of having "been affected primarily by the forces of nature" (as called for in Section 2(c) of the Wilderness Act) can be maintained. This is an unresolved, ongoing debate over the philosophy, spirit, and intent of the Wilderness Act. In the more practical vein, most visitors to wilderness areas at Sleeping Bear Dunes would not notice this direct management intervention in natural processes. Thus, Alternative 2's long-term impact on wilderness would be negligible or minor at most.

Fire is a natural force, and thus neither wildland fire use nor occasional prescribed fires are deemed by Federal land managers as being inherently incompatible with wilderness character and values. As a result of a massive 1999 blowdown (367,000 acres) in the nearby BWCAW, the USDA Forest Service, Superior National Forest conducted an EIS on fuel treatment within the Wilderness Area (SNF, 2001) and recently began large-scale prescribed burns to reduce hazard fuel loads there and the risk of catastrophic wildland fires that could escape the BWCAW. In Voyageurs National Park, northwest of the Lakeshore on the Minnesota-Canadian border, a new FMP also allows for prescribed fires in recommended wilderness areas, though natural fire ignition is emphasized.

Noise associated with both prescribed fire and fire suppression activity within or near the Lakeshore's recommended wilderness would probably last no more than a few days or weeks per decade, more or less. As noted above, this would not represent a significant intrusion into wilderness, especially in the context of other mechanical sounds in the area emanating from land, lake, and air.

Alternative 3 – Suppress All Wildland Fires on Mainland, Allow WFU on Manitou Islands, Permit Prescribed Fire (*Preferred Alternative*)

Like Alternative 2, Alternative 3 would actively utilize fire as a beneficial tool for habitat management and fuels reduction throughout the park. Unlike Alternative 2, it would also allow for wildland fire use on the two islands, most of which are recommended wilderness. All three of the activities associated with Alternative 3 – limited wildland fire use, prescribed fires, and some fire suppression – would not seriously compromise wilderness values. Rather, to the extent that more natural vegetation communities were fostered, this alternative would further the intent and spirit of the Wilderness Act. Overall, Alternative 3's adverse impacts on recommended

wilderness would likely be temporary and minor (e.g. smoke, noise), and its beneficial impacts modest and long-term.

Cumulative Impacts

Recommended wilderness areas in the park are already subjected to a host of unnatural influences, including noise from aircraft, automobiles, snowmobiles, and motorboats, air pollution and deposition of contaminants, reduced wildlife populations and modified vegetation communities, among others. In the future, large-scale disturbances related to human activity like climate change may call into question how "wild" any area is anymore. Still, to most visitors, the Lakeshore's wilderness areas retain much of their wild character. None of the FMP alternatives would cause an impairment of these attributes.

Conclusion

All of the FMP alternatives would largely respect wilderness values in the park, with adverse effects being limit to negligible or minor intensity. By allowing for greater wildland fire use in at least some of the park, in a pure philosophical sense Alternative 3 would arguably comply most thoroughly with the intent of the Wilderness Act. On the other hand, because the historic fire regime cannot recur – since fires ignited outside the park that once would have crossed into it are now much less likely to do so – even Alternative 3 would not be able to recreate the pre-settlement ecosystem that once existed within what is now proposed as wilderness.

In sum, the implementation of any of the alternatives would not impair wilderness or related values that are (1) necessary to fulfill specific purposes identified in the enabling legislation of Sleeping Bear Dunes National Lakeshore, (2) key to the natural or cultural integrity of the park or opportunities its enjoyment, and (3) identified as a goal in the park's General Management Plan or other National Park Service planning documents.

4.2.9 Noise

Methodology for Assessing Impacts

Impacts from noise associated with proposed fire management activities at Sleeping Bear Dunes National Lakeshore were evaluated qualitatively by examining probable patterns (location, duration, timing and frequency) of noise-generating activities in the context of NPS management policies and the existing acoustical environment at the Lakeshore. Noise levels were also quantitatively determined using the Highway Construction Noise Measurement, Prediction, and Mitigation methodology (Federal Highway Administration). Noise impacts were then assessed with respect to the location of sensitive receptors. None of the alternatives would significantly impact the soundscape of the national lakeshore.

General Impacts

Noise has the potential to impact both humans and wildlife. For humans, noise can affect recreational experiences and the enjoyment of wilderness values. For wildlife, noise may disrupt

activities such as feeding, breeding, and nesting. This is of particular concern for Threatened and Endangered Species.

Noise disturbance is one of the primary impacts of both fixed-wing aircraft and helicopters used in fire suppression. With the use of helicopters, the potential for noise impacts increases, as flight frequency normally increases dramatically and missions expand to include landings.

In general, laboratory studies and limited field research to date have discovered four principal ways in which wildlife may be adversely affected by noise pollution:

- hearing loss, resulting from noise levels of 85 db or greater;
- masking, or the inability to hear important environmental cues and animal signals;
- non-auditory physiological effects, like increased heart rate and respiration and general stress reaction; and
- behavioral effects, which vary widely between species and noise characteristics, resulting in, for instance, abandonment of territory and lost reproduction (Cornman, 2001).

Three of the principal noise-generating, motorized devices that would be used in each of the FMP alternatives are chainsaws, helicopters and propeller aircraft. Chainsaws can reach 110 dB (Health & Safety Executive, 2000), helicopters 105 dB and propeller aircraft 120 dB (Roeser, no date). While each of these devices exceeds the 85 dB threshold cited above, sound and noise are attenuated (reduced in intensity) with distance; both forest cover and uneven terrain accentuate the rate of sound attenuation (NYDEC, 2001). Thus, at the Lakeshore, adverse effects on wildlife from the use of this fire-related equipment are likely to be localized and temporary, although much more field research in the area of noise impacts on wildlife would be necessary to render a more definitive assessment. Noise per se is only part of the overall disturbance to which wildlife is subjected with the introduction of motors, human traffic, and fire itself into their habitat or nesting sites.

Noise calculations were performed for mechanical and thinning activities using the Federal Highway Administration's Construction Noise Measurement, Prediction, and Mitigation methodology. Noise level calculations were performed assuming that obstructions that may impede the propagation of sound (buildings, vegetation, etc.) were not present, and that the land between the source of the sound and the receiver was flat. Thus the noise level calculations should be considered a "worst-case" measure. Based on the noise modeling calculations, ambient sound levels of about 45 dBA characteristic of wilderness or backcountry would be reached at a distance of approximately 5,000 feet (i.e. about one mile or 1.5 km) from the source of manual and mechanical thinning activities. Sound levels would be reduced even further if noise-generating activities occurred within dense vegetation, especially conifer forests. Dense vegetation that is at least 100 ft. deep would reduce the sound levels by 3 to 7 dBA (NYDEC, 2000). Thus, ambient noise levels of 65 dBA could be reached within 2,500 ft. (about one-half mile or 0.8 km) of project operations with the previous assumptions.

Since wildland and/or prescribed fires can occur virtually anywhere in the entire terrestrial surface area of the park, the use of chainsaws, vehicles, planes and helicopters could also

potentially occur anywhere in the park under each of the alternatives below. However, at any given place within the park, the use of this mechanized equipment will be very infrequent, on the order of hours, days, or at most weeks per decade. This is not frequent enough to substantially interfere with recreational human activities in the area or with wildlife behavior. Nor will such infrequent bursts of noise chronically impair the solitude and tranquility associated with wilderness.

Two other relevant factors in considering the impacts from FMP-associated noise are: 1) the general paucity of "noise-sensitive receptors" (e.g. schools, hospitals, nursing homes, churches) within and adjacent to the national park; and 2) the widespread, persistent noise from park users, nearby residential areas, and the engines of automobiles, aircraft, and snowmobiles that already penetrate the park. Sleeping Bear Dunes does not possess a pristine acoustic environment, in spite of its scenic, rural landscape. Relative to existing ambient noise levels, impacts from the FMP alternatives below are comparatively inconsequential.

Nevertheless, steps can be taken to mitigate the impact of noise associated with fire suppression and fuels treatment at the Lakeshore. To reduce noise impacts from overflights, the Fire Management Officer would review any fire suppression activities or wildland fire use within three miles of known faunal Threatened and Endangered Species locations. No direct overflights of known active bald eagle nests would be allowed without the Superintendent's approval below 1,500 feet above ground level during the nesting season (approximately March to July). Aerial overflights associated with fire management operations should be restricted to 1,500 feet above ground level whenever possible.

Fuel treatments near the campgrounds and developed areas would be restricted to times of low visitor use (weekdays during the off-season) of the park to minimize and/or eliminate noise impacts on recreationists and visitors whenever possible.

Alternative 1 – No Action (Suppress All Wildland Fires and Exclude Prescribed Fire)

In the recent past wildland fires have affected a relatively small area of the park. Thus, the expected extent of impacts from the No Action Alternative would be relatively small, but extreme droughts could increase the affected area.

Noise from fire suppression activity under Alternative 1 would probably last no more than a few days or weeks per decade, more or less. This should be placed in the context of the Lakeshore's proximity to noise-generating automobiles and trucks, snowmobiles, aircraft and motorboats wide access over much of it on a daily basis. Thus, noise impacts from the No Action Alternative would be temporary, localized and negligible to minor.

Alternative 2 – Suppress All Wildland Fires But Permit Prescribed Fire

Under this alternative, prescribed fire could be used throughout the park. Like the other alternatives, the noise impacts of Alternative 2 are likely to be temporary, localized, and negligible to minor in intensity. With a greater rate of prescribed fire, noise would generally be more spread out over time, and would emanate more from chainsaws than helicopters or fixed-wing aircraft.

Alternative 3 – Suppress All Wildland Fires on Mainland, Allow WFU on Manitou Islands, Permit Prescribed Fire (*Preferred Alternative*)

Like the previous alternative, the noise impacts of Alternative 3 are likely to be temporary, localized, and negligible to minor in intensity.

Cumulative Impacts

Although there is not a constant level of ambient, artificial noise from nearby communities, passing motorboats, automobiles, trucks, aircraft, and snowmobiles, these sources generate intermittent, motorized noise that extends into the park on a daily basis during most of the year. Against this background, the potentially loud but localized and highly infrequent incidents of noise from fire management activities, including wildland fire suppression, prescribed burning and mechanical thinning, would not add significantly to the cumulative noise burden of the national lakeshore.

Conclusion

In sum, the implementation of any of the alternatives would not generate noise that would impair wilderness or other related park values that are (1) necessary to fulfill specific purposes identified in the enabling legislation of Sleeping Bear Dunes National Lakeshore, (2) key to the natural or cultural integrity of the park or opportunities its enjoyment, and (3) identified as a goal in the park's General Management Plan or other National Park Service planning documents.

4.3 CULTURAL RESOURCES

Methodology for Assessing Impacts

Impacts to cultural resources were assessed qualitatively by examining literature on the impact of fires and fire suppression on cultural resources and by discussions with archeologists and cultural resource authorities.

Management and protection of cultural resources within the Federal Wildland Fire Management Program is a complex process (Gleeson and Jones, 2000). At present, Federal land managers, including the NPS, USFS, BIA, BLM and USFWS, are working jointly to develop a comprehensive management strategy and Programmatic Agreement (PA) that is consistent with Section 106 of the Historic Preservation Act. The goal is to protect historic sites, structures, landscapes and traditional cultural sites while meeting fire management objectives.

General Impacts and Mitigation

The effects of fire on cultural resources are still not completely understood or documented. To date, much of the literature on the subject is anecdotal and qualitative (Gleeson and Jones, 2000), rather than based on controlled scientific studies. For example, post-fire observations are often unable to distinguish between damage to archeological resources caused by the fire itself from damage that

was pre-existing. Thus, the following discussion of potential impacts of fire and fire management on cultural resources is of necessity general and somewhat speculative.

Both wildland fires and wildland fire suppression can affect cultural resources and historic properties. Fires themselves can and often do destroy historic structures or properties, especially those constructed of wood or other flammable material. Historic districts and cultural landscapes are also somewhat vulnerable to adverse impacts or destruction from wildland fires.

The vulnerability of subsurface archeological resources and artifacts to fire depends not only on the nature of the materials themselves but on the intensity of the fire and on soil moisture. Hotter surface fires penetrate more deeply into the subsurface and can potentially cause more damage. Glass bottles can be cracked or broken for example. On the other hand, ceramics or objects carved or chipped from stone are likely to be more resistant to fire and heat. Soil moisture reduces soil heating and also determines whether duff and litter will burn, which increases exposure to high temperatures. Since fires occasionally burned the Great Lakes landscape for centuries prior to the era of fire exclusion in the 20th century, for a subsurface historic object or archeological artifact to have survived into the 21st century, it must have already withstood at least several and sometimes many previous fires.

Clearing firelines associated with fire suppression can damage subsurface cultural and archeological resources by exposing, crushing, or removing them. The use of MIST will minimize this.

The Lakeshore's archeological and historical resources are limited and nonrenewable; many are fragile as well. When disturbed or removed from their context, the scientific information they could furnish is often lost forever. Precautions would be taken during fire suppression and prescribed fire activities in the park (e.g. MIST) not to destroy or disturb important archeological and historical resources. A complete ground survey and inventory with detailed maps of sites, features, and environmental data are the best sources of cultural resources information for fire management planning; archeological and historical site surveys in the park are ongoing. The list of historic buildings, structures, even mapping of cultural landscapes are available to researchers who request them. Archeological research is still in its early stages, but archeologists can provide great insight on what to expect or what not to expect at other unsurveyed areas of the park.

Fire management activities that disturb the ground in any way, such as fireline construction using hand tools or heavy equipment, would use paraprofessional and professional archeologists working in cooperation with firefighters and pre-burn preparation crews to prevent needless cultural resource destruction. Paraprofessionals would be limited to working with, and being directed by, professional archeologists. During a wildland fire the highest priorities are safety and controlling the blaze; therefore, if the fireline cannot be diverted, cultural resources may have to be sacrificed. In most cases, however, damage can be averted. For all three of the FMP alternatives below, during fire suppression, prescribed fire, and rehabilitation activities, the following measures would be undertaken to help mitigate the impacts of fire suppression and rehabilitation on cultural resources:

- Fire management staff will provide the park Cultural Resource Specialist with prescribed burn plans with sufficient lead time and information to conduct

archeological investigation, identify potential landscape features and consult with Indian tribes.

- Fire management staff will inform park Cultural Resource Specialist of wildland fires and suppression activities as soon as possible.

- Park Cultural Resource Specialist will provide fire management staff with information about known cultural resources in prescribed fire units and recommend protective measures. All cultural resources located in or near prescribed fire units will be protected to the extent possible.

- Park Cultural Resource Specialist will consult with and seek advice from other cultural resource specialists as appropriate if cultural resources are threatened or destroyed during wild fires.

In addition, fire management staff will keep the Lakeshore's Cultural Resource Management Specialist informed as to upcoming prescribed fire and suppression activities. The Cultural Resource Management Specialist, in turn, will inform and consult with the Michigan State Historic Preservation Office (SHPO) and Indian tribes, and if necessary, the Advisory Council on Historic Preservation, on forthcoming projects and activities, such as prescribed burns for hazard fuel reduction in the vicinity of historic properties, to ensure compliance with Section 106 of the NHPA.

Archeologists have never recorded any clear evidence for adverse impacts to archeological materials at SLBE from previous wildland fires, so it may not be that difficult to assess damage from future fires. Wildland fires are not expected to adversely impact most prehistoric sites, since they are typically protected by a thick layer of forest duff. Sites exposed in dunes are unlikely to be impacted by fire, since fuels are absent or sparse. Movement of equipment, cutting of fire breaks, and similar activities are greater threats to prehistoric site integrity than the impacts of the actual fires. Historic archeological sites are much more susceptible to damage from fire, since the artifacts often occur on or near the ground surface. For planning purposes, all historic structural locales, farmsteads, etc., should be assumed to have archeological components.

With good planning, it is likely that prescribed burns can be conducted that would have minimal impact upon archeological resources at the Lakeshore. A recent synthetic report on the impacts to archeological resources from fire concludes: "The data presented here show that prescribed burning can be conducted with limited impact to archaeological resources in several vegetative communities. However, in environments where heavy ground fuels are present, it is critical that hazardous fuels are removed or reduced in the immediate vicinity of important archaeological sites in order to mitigate the potential for significant thermal alteration of archaeological materials" (Buenger, 2003: p. 136).

Alternative 1 – No Action (Suppress All Wildland Fires and Exclude Prescribed Fire)

In the recent past wildland fires have affected a relatively small area of the park. Thus, the expected extent of impacts from the No Action Alternative would be relatively small, but extreme droughts could increase the affected area.

In general, Alternative 1 would result in long-term, regional impacts to cultural resources that are minor to moderate in intensity. This relatively high rating of impact intensity is because of the long-term risk of a large, uncontrollable fire that Alternative 1 would probably result in over time. By attempting to exclude all fires, both wildland and prescribed, from the park, Alternative 1 would contribute to rising fuel levels in the Lakeshore's forests. Eventually, under extreme drought conditions that would occur sooner or later in the area, these high fuel levels could produce fires that might be intense, hot, fast-moving, and difficult to suppress. While historic buildings, structures, and properties and other cultural resources could be proactively protected to some extent by fuel treatments and mechanical fuel reduction in a surrounding zone or "defensible space," this would not totally eliminate the hazard faced by at least some of the 350 historic structures at the Lakeshore eligible for the National Register of Historic Places.

In addition to the general cultural impacts discussed in the beginning of this section, this alternative may have both beneficial and adverse impacts on the park's cultural landscapes. Park management would aim to preserve these landscapes from the adverse effects of fire, such as the damage or destruction of structures, but without prescribed fire to manage plant growth, vegetation composition, and succession, it may be more difficult to maintain the vegetation or appearance of some of the landscapes. Ethnographic resources in the park are relatively undocumented, so it is not possible to predict precise effects of Alternative 1 on these resources, or whether they would even be predominantly positive or negative, but there would certainly be impacts.

Alternative 2 – Suppress All Wildland Fires But Permit Prescribed Fire

Overall, Alternative 2 would result in long-term, regional impacts on cultural resources, including cultural landscapes and ethnographic resources, which are negligible to minor in intensity. The general impacts discussed above, in the introduction to this section, from wildland fires, prescribed fires and fire suppression actions, all apply to Alternative 2. The most important feature of this alternative is that by using prescribed fire to help reduce and control the buildup of fuels, it would largely avoid the kinds of catastrophic fires that would probably occur sooner or later under Alternative 1. Unplanned fires would occur under this alternative, but they would generally not have the fuel and energy to become so powerful and unpredictable as to threaten the park's many historic structures and other cultural resources.

Alternative 3 – Suppress All Wildland Fires on Mainland, Allow WFU on Manitou Islands, Permit Prescribed Fire (*Preferred Alternative*)

The impacts of Alternative 3 on cultural resources, including archeological resources, historic structures, cultural landscapes and ethnographic resources, would be virtually identical to those of Alternative 2: long-term, regional, and negligible to minor. Alternative 3 would also benefit both historic and archeological resources by providing a greater degree of protection from unwanted wildland fires than the No Action Alternative.

Cumulative Impacts

As stated at the outset of this section, cultural resources are limited and non-renewable and many are fragile, such as the Lakeshore's historic structures. Over time, forces ranging from rust to erosion, microbial action, weathering, rainfall, oxidation, and vandalism all take their toll on the continued existence and integrity of archeological, historical, and cultural resources. Fire management can be conducted in such a manner as to protect known cultural resources like historic structures/properties and cultural landscapes and to minimize adverse effects on other resources such as undiscovered subsurface archeological artifacts.

Overall, none of the alternatives would be likely to contribute to significant adverse cumulative impacts on cultural resources.

Conclusion

By implementing the same mitigation measures, each of the three FMP alternatives would provide a degree of protection for historic and archeological resources, both known and undiscovered, that would likely be able to keep impacts from fire management activities to an acceptable minimum. Alternatives 2 and 3 would provide the greatest amount of protection for historic structures in particular, due to their use of prescribed fire to control the buildup of hazard fuels.

In sum then, the implementation of any of the alternatives would not impair cultural resources or related values that are (1) necessary to fulfill specific purposes identified in the enabling legislation of Sleeping Bear Dunes National Lakeshore, (2) key to the natural or cultural integrity of the park or opportunities its enjoyment, and (3) identified as a goal in the park's General Management Plan or other National Park Service planning documents.

4.4 SOCIAL AND ECONOMIC ENVIRONMENT

Impacts to the social and economic environment were assessed qualitatively by examining land use information, socioeconomic and demographic data from the U.S. Census Bureau, human health and safety precautions of the FMP, and public services in the area and then predicting the likely effects of wildland fires, prescribed fires, and fire suppression on these factors, based on what is known about wildland fire use, fire management and fire suppression.

4.4.1 Land Use

Methodology for Assessing Impacts

Impacts on land use were assessed qualitatively by examining information on land use patterns and then predicting the likely effects of wildland fires, prescribed fires, and fire suppression on land use.

Alternative 1 – No Action (Suppress All Wildland Fires and Exclude Prescribed Fire)

In the recent past wildland fires have affected a relatively small area of the park. Thus, the expected extent of impacts from the No Action Alternative would be relatively small, but extreme droughts could increase the affected area.

Overall, during most years, Alternative 1 would have temporary, local, negligible adverse effects on land use in the area. The wildland fire suppression function confers major benefits to residents, visitors, property and adjacent land uses in the surrounding communities that far outweigh its relatively negligible adverse impacts.

However, over the long term, and probably well beyond the lifetime of this FMP, the rare but destructive fires that this alternative would help foster – by allowing hazard fuels to accumulate – could have moderate to major adverse effects on surrounding land uses, both from smoke and from the risk to structures and landscaping posed by large, fast-moving wildland fires.

Michigan has a long history of uncommon, but extreme weather events that produce very hazardous conditions for major forest fires (MDNR, 2003b). The greater the accumulated fuel, especially within the wildland-urban interface, the higher the risk of a catastrophic wildland fire that is difficult to suppress before it damages or destroys houses and other structures. In Michigan, despite highly trained firefighters equipped with modern specialized equipment, wildland fires are still capable of serious damage: one fire in 1990 destroyed 76 homes and 125 other structures in a single afternoon (MDNR, 2003c). The growth of homes and other developed property in close proximity to the Lakeshore only exacerbates the problem. This is reflective of a larger nationwide trend: with increasing human populations, demographic shifts, and more people and homes concentrated in or next to wildlands, more private property will be exposed to catastrophic wildland fires (USDA Forest Service, 2000c). From 1985 to 1994, wildland-urban interface fires destroyed almost 9,000 homes around the country.

While Alternative 1 would allow for mechanical thinning to reduce hazardous fuels, the high cost and other drawbacks of this treatment, would prohibit utilizing it over wide areas of the park. Biological treatment (e.g. consumption of plants by animals such as goats or cows that would graze an area) and large-scale chemical treatment (e.g. use of herbicides) are generally not appropriate in a national park.

Alternative 2 – Suppress All Wildland Fires But Permit Prescribed Fire

Impacts of this alternative would be temporary, both localized and regional, negligible to minor adverse. By avoiding wildland fire use and probably having smaller wildland fires and fewer of them (because of prescribed burns that reduce fuel loads), this alternative distributes impacts more evenly over time. This alternative entails a rather small but real risk of escaped prescribed fires that could cause localized damage to structures and property outside the park.

As the science, techniques and tools of fire management improve, the safety and control record of prescribed fires is likely to continue to improve. Nevertheless, even the best-planned prescribed fires can escape, and fire managers must balance the risk of prescribed fire against the

risk of a wildland fire that could be harder to control and result in more severe impacts to property (BLM, 2003; Wilent, 2002).

Yet one of the most important justifications for prescribed burning is to reduce the naturally occurring fuels within forest areas, particularly those forests in close proximity to urbanizing areas, that is, the wildland-urban interface (Forest Protection Bureau, 2003). Reducing these forest fuels reduces the risk of major life and property-threatening wildland fire. Wildland fire management professionals are virtually unanimous in their conviction that prescribed fire is one of the most effective tools of any fire prevention and protection program (Brown, 1999). Properly managed fire will reduce the risks to society associated with catastrophic wildland fires, including threats to property (USEPA, 1998; City of Boulder, 2003).

To mitigate the potential impacts of this alternative, the Lakeshore would do the following:

- Cooperate with adjacent property owners, especially those with improved property containing structures and residences, to use mechanical thinning or other non-fire treatments to reduce hazardous fuels within the wildland-urban interface so as to create a defensible space around vulnerable structures.

- Notify adjacent property owners and residents of upcoming prescribed fires by means of newspaper articles, public service announcements on local broadcast media, letters and/or other means.

Alternative 3 – Suppress All Wildland Fires on Mainland, Allow WFU on Manitou Islands, Permit Prescribed Fire (*Preferred Alternative*)

Impacts of this alternative are very similar to those of Alternative 2: temporary, both localized and regional, negligible to minor adverse. By avoiding Wildland Fire Use on the mainland, and probably having smaller wildland fires and fewer of them (because of prescribed burns that reduce fuel loads), this alternative distributes impacts more evenly over time. Like Alternative 2, this alternative entails a rather small but real risk of escaped prescribed fires that could cause localized damage to structures and property outside the park. The risk from this has to be weighed against the risk of uncontrollable wildland fires that would be less frequent but possibly much more severe and damaging. Allowing for Wildland Fire Use on the Manitou islands, but limiting it to those islands, which are well removed from the mainland, and in a more primitive, or backcountry (proposed wilderness) condition, would not affect private property on the mainland in any way. Private properties and interests on the islands would not be substantially affected either, because wildland fires would be suppressed rather than allowing them to spread to private holdings.

The mitigation measures for Alternative 2 also apply to Alternative 3.

Cumulative Impacts

Alternative 1 would contribute to cumulative impacts on land use in the area by allowing for the accumulation of hazardous fuels within the wildland-urban interface, an accumulation that appreciably raises the risk of catastrophic wildland fires that could damage property.

Conclusion

None of the alternatives would significantly impact surrounding land uses in typical years. Impacts from wildland fires, wildland fire use, prescribed fires, and fire suppression on land use would be generally temporary, localized to regional, and range from negligible to minor in intensity. Land use impacts would mostly take the form of smoke and risk to property (principally structures) and vegetation from escaped or uncontrolled fires; these risks are greater with Alternative 1 because this alternative allows for the continuing buildup of hazard fuels. In contrast, implementing the preferred FMP alternative (#3) or Alternative 2 would generally diminish the risk of severe wildland fires.

4.4.2 Human Health and Safety

Methodology for Assessing Impacts

Impacts on human health and safety were assessed qualitatively by examining information on land use patterns and then predicting the likely effects of wildland fires, prescribed fires, and fire suppression on human health and safety.

Alternative 1 – No Action (Suppress All Wildland Fires and Exclude Prescribed Fire)

In the recent past wildland fires have affected a relatively small area of the park. Thus, the expected extent of impacts from the No Action Alternative would be relatively small, but extreme droughts could increase the affected area.

Overall, during most years, Alternative 1 would have temporary, local, negligible adverse effects on human health and safety. It should be recognized that the wildland fire suppression function alone confers major benefits to the health and safety of park visitors and staff as well as nearby residents.

However, over the long term, and probably well beyond the lifetime of this FMP, the rare but destructive fires that this alternative would help engender could have moderate to major impacts on the health and safety of park staff, firefighters, visitors and the residents of surrounding communities. Both the smoke and flames from wildland fires can be harmful to humans.

Due to the backcountry nature of the Manitou islands, an unexpected fire could threaten the safety of visitors. Under extreme conditions, entrapment on the island would be possible, although most campgrounds and developed areas are close to the Lake Michigan shore. On South Manitou Island, the current ferry schedule could allow removal of people from the island. The north island is different, since the ferry stays only long enough to reload and return to Leland. In both locations visitors might be forced to go to the historic sites for safety.

Federal wildland fire policy now requires that all fire management activities consider safety of personnel and the public as the highest priority. Consequently, Sleeping Bear Dunes National Lakeshore would adopt measures to help ensure this under Alternative 1:

- The general public will be made aware of wildland fires through press releases and general interpretive presentations.

- The general public will not be allowed access to any areas affected by fire.

- Safety briefings will be conducted for NPS personnel prior to any participation in wildland suppression.

- All fire personnel will be reminded of the "18 Situations That Shout Watch Out" and will be expected to comply with the "10 Standard Fire Orders".

Alternative 2 – Suppress All Wildland Fires But Permit Prescribed Fire

Impacts of this alternative on human health and safety would be temporary, localized, and negligible to minor adverse. Suppressing all wildland fires would confer the same benefits as in Alternative 1. By avoiding wildland fire use and probably having smaller wildland fires and fewer of them (because of prescribed burns that reduce fuel loads), this alternative distributes impacts more evenly over time. Risks of significant impacts to human health and safety would be lower than Alternative 1, because this alternative would probably avoid catastrophic wildland fires by more effectively controlling the accumulation of hazard fuels. Mitigation measures are similar to those of Alternative 1:

- The general public will be made aware of wildland fires and prescribed burns through press releases and general interpretive presentations.

- Access to areas affected by fire will be restricted until hazards to the general public have been mitigated.

- Safety briefings will be conducted for NPS personnel prior to any participation in wildland suppression or prescribed burns.

- Appropriate regulatory and/or enforcement agencies will be notified prior to any prescribed burns to assist in safely managing pedestrian, equestrian or vehicular traffic. Warning signs will be posted along roads and trails as necessary.

- All fire personnel will be reminded of the "18 Situations That Shout Watch Out" and will be expected to comply with the "10 Standard Fire Orders" and LCES.

Alternative 3 – Suppress All Wildland Fires on Mainland, Allow WFU on Manitou Islands, Permit Prescribed Fire (*Preferred Alternative*)

Generally, impacts of Alternative 3 would be similar to those of Alternative 2: temporary, localized, and negligible to minor adverse. Suppressing all wildland fires on the mainland would confer benefits on human health and safety to park staff, visitors, and nearby residents. By allowing for WFU on the Manitou Islands, this alternative would have to be especially attentive to effectively reaching and notifying visitors to those islands, and preventing access to the fire areas, or the islands in their entirety, during WFU events. Otherwise, mitigation measures for this alternative are the same as listed under Alternative 2.

Cumulative Impacts

None of the alternatives should contribute to adverse cumulative impacts on human health and safety in the area.

Conclusion

In a typical year, none of the alternatives, if implemented, would significantly impact the health and safety of park visitors and staff, or the surrounding communities. Under each alternative, protecting firefighter and public health and safety is the top priority. However, by not addressing the continued buildup of hazard fuels in the park, which could over time potentially lead to a catastrophic wildland fire in the area, Alternative 1 runs a higher risk of endangering human health and safety over the long term.

4.4.3 Public Services

Methodology for Assessing Impacts

Impacts on public services were assessed qualitatively by examining information on land use patterns and then predicting the likely effects of wildland fires, prescribed fires, and fire suppression on public services.

Alternative 1 – No Action (Suppress All Wildland Fires and Exclude Prescribed Fire)

In the recent past wildland fires have affected a relatively small area of the park. Thus, the expected extent of impacts from the No Action Alternative would be relatively small, but extreme droughts could increase the affected area.

Overall, during most years, Alternative 1 would have temporary, local, negligible to minor adverse effects on public services in the area. However, over the long term, and perhaps well beyond the five-year life of this FMP, the rare but destructive fires that this alternative would help bring about could have moderate to major adverse effects, but temporary ones, on the public services of surrounding communities. The local public service most affected would be firefighting, as it is now. Other public services that would be impacted include law enforcement, search and rescue, and emergency medical care. Potential impacts include both the fiscal burden to local communities (cost of providing services) and co-opting limited personnel resources, thus temporarily shortchanging other important assignments.

Alternative 2 – Suppress All Wildland Fires But Permit Prescribed Fire

Overall, Alternative 2 would likely result in temporary, local, minor adverse effects on public services in the area. Prescribed fire should not place any additional burden on local resources except in the very unlikely event of an escape, in which case local fire fighting resources may be called upon to protect structures or provide other assistance. However, over the long term, the use of prescribed fires that would occur under Alternative 2 would reduce hazard fuels in the wildland-urban interface, and thus substantially reduce the risk of rare but destructive fires that would eventually occur under the No Action Alternative (#1). As with Alternative 1, the local

public service most affected would be firefighting, as it is now. Other public services that would be impacted include law enforcement, search and rescue, and emergency medical care. Potential impacts include both the fiscal burden to local communities (cost of providing services) and co-opting vital personnel from other missions.

Alternative 3 – Suppress All Wildland Fires on Mainland, Allow WFU on Manitou Islands, Permit Prescribed Fire (*Preferred Alternative*)

Impacts of this alternative are very similar to those of Alternative 2: temporary, localized, and minor adverse in most years. As with Alterative 2, there would be a small risk of impacts to public services from escaped prescribed fires in any given year. Taking on this risk would help reduce the risk (from year to year) of a catastrophic wildland fire. In any given year, the chance of such a damaging fire occurring would be small, smaller than the risk of an escaped prescribed fire, but over time its occurrence would have to be considered inevitable.

Cumulative Impacts

It is unlikely that any of the alternatives would contribute to significant cumulative impacts on public services.

Conclusion

In most years, all alternatives would produce no more than minor effects on the cost and availability of local public services. Alternatives 2 and 3 would run a somewhat higher risk of greater impacts to public services due to the possibility of escaped prescribed fires. Alternative 1, in contrast, while generating no risk from prescribed fire (since this alternative does not practice it), would run a higher risk of rare catastrophic fires over the long term, with concomitant greater impacts on public services supplied by towns, townships, and counties.

4.5 PARK FACILITIES AND OPERATIONS, VISITOR USE AND EXPERIENCE

Methodology for Assessing Impacts

Impacts to the park facilities and operations, visitor use and experience were assessed qualitatively by using professional judgment and experience, as well as discussions with park officials, to predict the likely effects of wildland fires, prescribed fires, and fire suppression on facilities, operations and visitors, based on known features and characteristics of WFU, fire management and fire suppression.

Alternative 1 – No Action (Suppress All Wildland Fires and Exclude Prescribed Fire)

In the recent past wildland fires have affected a relatively small area of the park. Thus, the expected extent of impacts from the No Action Alternative would be relatively small, but extreme droughts could increase the affected area.

Overall, Alternative 1 would have short-term, localized and negligible impacts on park facilities and short-term, localized and negligible to minor adverse impacts on park operations. Its impacts on visitor use and experience would likely be long-term, regional in extent and minor in magnitude. Very infrequently, perhaps once every few decades, both park operations and the visitor experience would be subjected to moderate or major, short-term adverse impacts, as a result of one or more intensive wildland fires that could not be controlled easily.

Under Alternative 1, major park facilities would be protected by suppression in which mechanical hazard fuel reduction could be practiced and active suppression undertaken during wildland fires.

Three principal kinds of impacts would occur with regard to visitor use and experience: smoke, the appearance of burned areas, and closures. The first is invariably negative, but can be minimized by swift and appropriate suppression and mop-up tactics.

With regard to the second impact on visitor experience – the sight of burned areas – to the visitor uninformed about the "new" understanding of fire's essential role in the natural ecology of the Great Lakes landscape, a recently burned forest might appear to have been damaged or destroyed. This adverse impact on visitor experience can be substantially mitigated through education. Furthermore, new vegetation that appears a season or two after burning is considered by many to be very appealing. However, if a rare, catastrophic fire were to strike the park, the possibility of which is greater under this FMP alternative, it would be exacerbated by the fuel accumulation this FMP alternative would allow to continue unabated; thus, the visual impact would be even more striking.

Area closures would occur to a limited extent under this alternative, inconveniencing some visitors and preventing recreation in some sites temporarily. Generally, this impact would be temporary, localized and minor adverse. Visitor reaction can be improved by education and information about the park's fire management program. Again, however, area closures could be more extensive and longer-lasting in the rare years that large, intensive wildland fires struck the park.

Disseminating information about fire prevention and management is an important step in establishing public support for such programs. The Lakeshore's wildland fire management information program would be used in Alternative 1, while Alternatives 2 and 3 have a slightly modified version. The following guidelines would be followed:

- Timely and accurate information will be provided to the media and lakeshore visitors regarding the status of fire actions and suppression efforts.

- Informational handouts explaining the fire management program will be prepared and updated as necessary.

- Adjacent landowners will be notified when wildland fire is a threat to off-unit residential areas, inholdings and life estate properties.

- When the staffing class is at SC-IV or SC-V (during times of heightened fire danger), information will be prominently displayed at visitor contact points. Patrol activity on both mainland and islands units may be increased to detect potential fires and to monitor visitor activity. At SC-V it may become necessary to close portions of the park to protect the public.

Alternative 2 – Suppress All Wildland Fires But Permit Prescribed Fire

In general, Alternative 2 would have short-term, localized and negligible to minor impacts on park facilities and short-term, localized and negligible to minor adverse impacts on park operations. Its impacts on visitor use and experience would likely be both adverse and beneficial. Adverse effects on visitor use and experience would be temporary to short-term, localized to regional in extent and negligible to minor in magnitude. Beneficial effects on visitor use and experience would be long-term, localized to regional, and minor to moderate. Through its proactive program of hazard fuel reduction using prescribed fire, this alternative would substantially lower the long-term risk of highly infrequent but potentially catastrophic wildland fires that could have moderate to major impacts on park facilities, operations and visitor use and experience.

Area closures from both prescribed fires and wildland fire suppression actions would occur to a limited extent under this alternative, inconveniencing some visitors and preventing recreation in some sites temporarily. Generally, this impact would be temporary, localized and minor adverse. Visitor reaction can be improved by education and information about the park's fire management program. Alternative 2 would likely avoid the larger, longer area closures in the rare years that large, intensive wildland fires struck the park, as would probably occur eventually with Alternatives 1 and 3.

Disseminating information about fire prevention and management is an important step in establishing public support for such programs. Under Alternative 2, the Lakeshore would use a slightly different wildland fire management information program than that used in Alternative 1. The following guidelines would be followed:

- Timely and accurate information will be provided to the media and lakeshore visitors regarding the status of fire actions and suppression efforts.

- Informational handouts explaining the fire management program will be prepared and updated as necessary. During periods when prescribed or wildland use fires are burning, these handouts will be distributed to both visitors and local residents.

- The prescribed burn program will be discussed in informal contacts with all unit personnel, neighbors and visitors.

- Adjacent landowners will be notified when fire, particularly wildland fire, is a threat to off-unit residential areas, inholdings and life lease properties.

- When the staffing class is at SC-IV or SC-V (during times of heightened fire danger), information will be prominently displayed at visitor contact points. Patrol activity on

both mainland and islands units may be increased to detect potential fires and to monitor visitor activity. At SC-V it may become necessary to close portions of the park to protect the public.

Alternative 3 – Suppress All Wildland Fires on Mainland, Allow WFU on Manitou Islands, Permit Prescribed Fire (*Preferred Alternative*)

Alternative 3's impacts on park facilities and operations, visitor use and experience would be similar to Alternative 2's. In general, Alternative 3 would have short-term, localized and negligible to minor impacts on park facilities and short-term, localized and negligible to minor adverse impacts on park operations. Its impacts on visitor use and experience would likely be both adverse and beneficial. Adverse effects on visitor use and experience would be temporary to short-term, localized to regional in extent and negligible to minor in magnitude. Beneficial effects on visitor use and experience would be long-term, localized to regional, and minor to moderate. Through its proactive program of hazard fuel reduction using prescribed fire, and by allowing Wildland Fire Use on the Manitou Islands, this alternative would substantially lower the long-term risk of highly infrequent but potentially catastrophic wildland fires that could have moderate to major impacts on park facilities, operations and visitor use and experience.

Cumulative Impacts

There are no other reasonably foreseeable actions that would combine with the FMP to produce cumulative impacts on facilities, operations, or visitor use and experience.

Conclusion

None of the alternatives, if implemented, would significantly impact visitor use and experience, or related values that are (1) necessary to fulfill specific purposes identified in the enabling legislation of Sleeping Bear Dunes National Lakeshore, (2) key to the natural or cultural integrity of the park or opportunities its enjoyment, and (3) identified as a goal in the park's General Management Plan or other National Park Service planning documents.